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## ORIGINAL ARTICLES

### THE CONTROL OF GASEOUS METABOLISM APPARATUS

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CONTROL of measuring devices is essential in all research laboratories. The highest skill in manufacture and the closest inspection in packing can, as a rule, insure only that an instrument is perfect or is subject to certain well-known and stated corrections when it leaves the testing room. Clinical thermometers, for example, are always tested and correction certificates furnished, although too often not used. The moment that the instrument passes into the hands of an operator the element of misuse or abuse may enter, and all assurances as to the accuracy of the instrument will be very much lessened in value. Thus, the innumerable blood-pressure apparatus on the market need frequent checking against mercury (unless they employ a mercury gauge), to insure that the delicate adjustment of the Bourdon gauge has not been too roughly handled. In recent years the determination of the basal metabolism has been made possible for many practitioners by means of several forms of respiration apparatus, and today the market is flooded with them. The original forms were well tested, but various modifications have been introduced by manufacturers, and it is safe to say that few of these modified forms have ever been subjected to any strict controls. Consequently, the accuracy of apparatus not thus attested may reasonably be questioned.

Structurally very few of the existing forms of metabolism apparatus with which the Nutrition Laboratory has come in contact are wrong. They are for the most part, however, complicated, involve not a little technique, and should have a set of rigorous calculations, the mastery of which will educate the user as to what he is trying to do and also will inculcate in him a realization of the limitations of the apparatus and, above all, the variability of the human organism. The use of special devices, particularly to simplify calculations, introduces an expediency frequently of doubtful value. Thus, an operator who makes use of special dials, special scale readings, special indices of various kinds, diagrams, nomograms, and arbitrary correction factors, relies for the accuracy of his apparatus wholly upon

the manufacturer, who rarely has quantitatively tested the apparatus under conditions of actual physiological use.

The importance of controlling respiration apparatus can best be expressed by direct quotation from Dr. E. F. DuBois of the Russell Sage Institute of Pathology, whose published controls are the envy of all metabolism workers.

"When a laboratory first receives its respiration apparatus there should be a thorough testing for leaks and a recalibration of burettes, spirometers, etc. If possible the machine should be tested by an alcohol check. Next a series of many normal controls should be studied to see if the results conform to the normal standards. This, however, cannot prove the accuracy of the machine much closer than 5 per cent, but it is better than nothing and gives experience in the technic."

#### GENERAL PRINCIPLES AND HISTORY OF DEVELOPMENT OF CHEMICAL CHECKS

The accuracy of gaseous metabolism apparatus may be controlled by two methods, by the so-called "physiological control" and by chemical checks. Prior to the perfection of the technique for chemical checks practically the only method of controlling respiration apparatus was to determine the respiratory exchange of the same individual upon two or more different forms of apparatus. Obviously if the results agreed closely, there was the highest degree of probability that both forms of apparatus were correct. It is only rarely, however, that two wholly different forms of apparatus are regularly used to measure the metabolism of the same individual, and it has been the more common custom in research laboratories, particularly when respiration chambers are employed, to control the measurements of the gaseous metabolism by chemical checks. The essential features of a chemical check are (a) the provision for the introduction or production of a known amount of carbon dioxide within the respiration apparatus and the absorption of a definite amount of oxygen, and (b) the comparison of the measurements secured

with the respiration apparatus with the known or theoretical amounts of carbon dioxide produced and oxygen consumed.

The combustion of stearin candles was probably first employed for this type of control, but in more recent years it has been common practice to burn ether or alcohol. Thus, in the early researches of Atwater and his associates in the chemical laboratory of Wesleyan University, Middletown, Connecticut (the experiments with the first respiration calorimeter for humans), there were nearly as many control experiments with burning alcohol as there were experiments on human subjects<sup>2</sup>. Ether burned in the form of vapor was used to prove the accuracy of the original universal respiration apparatus in the Nutrition Laboratory<sup>3</sup> and also the clinical respiration chamber<sup>4</sup>, but for general use this highly volatile liquid is not to be recommended.

Ethyl alcohol can be obtained with a high degree of purity and its density can be accurately determined with a good pycnometer. It burns completely to carbon dioxide and water, and its combustion can be so adjusted as to produce nearly the amount of carbon dioxide that a man would produce, to absorb nearly the same amount of oxygen as a man would absorb, with a resultant respiratory quotient somewhat lower than that commonly obtaining with man, to be sure, but very constant. By using a good alcoholometric table, such as that of Morley<sup>5</sup>, the percentage of alcohol by weight is readily found. From the chemical composition of alcohol one can compute not only the amount of carbon dioxide and water vapor produced by the combustion of 1 gram of ethyl hydroxide containing a definite amount of water, but also the oxygen required for the combustion and, furthermore, the heat developed during its combustion. Hence this substance has long been in use for controlling the accuracy of respiration calorimeters.

In checking various types of respiration apparatus it is obvious that the amount of alcohol burned should be as nearly as possible proportional to the metabolism of the subject subsequently to be studied. Thus, when controlling metabolism apparatus for infants very small amounts of alcohol should be burned. Indeed, it has been our custom to burn about 1 gram of alcohol for one-half hour in a respiration chamber designed for infants. When one is checking an apparatus that is to be used in short experimental periods of about 10 minutes with adults, the alcohol is usually burned at the rate of 1 gram in 5 or 6 minutes. When a long experiment lasting many hours is to be made with a respiration chamber, the alcohol is introduced at essentially the same rate, but special provision is made for long-continued admission of the alcohol. Finally in very large chambers, where groups of individuals or animals are to be studied, the combustion of alcohol can be greatly increased so as to approximate that produced by the group of individuals.

With the general use of the short-period experiments on the plan of Zuntz and Geppert or by the so-called "Tissot method," one is brought into contact with a very complex apparatus hitherto but little controlled by chemical tests. The various types of gas-analysis apparatus were also formerly very difficult to control, although after the composition of uncontaminated outdoor air was established as being constant<sup>6</sup>, it was possible to control the accuracy of gas-analysis apparatus by analyses of outdoor air. To test the accuracy of a gasometer, however, and more especially to check up the combination of gas-measuring and analyzing devices demands a method for reproducing both the chemistry of respiration and the mechanics of respiration. This dominant thought was developed admirably by Dr. T. M. Carpenter of the Nutrition Laboratory in 1915, who devised and published the description of an apparatus for controlling an open-circuit respiration apparatus of the so-called Tissot type, with valves<sup>7</sup>.

More recently Carpenter and Fox<sup>8</sup> have applied successfully a mechanico-chemical device for use in alcohol check tests with certain forms of closed-circuit apparatus. This device consisted of a combination of hand spirometer raised and lowered by a motor, a finely graduated burette raised by a kymograph, and a special form of lamp. With this arrangement it was possible to approximate the conditions actually existing during a test with a human subject by simulating both the chemistry of respiration and the mechanics of respiration, i. e., a normal respiratory volume and respiration rate. This device has not received the attention it merits, and as it has since been improved and as repeated inquiries have been made regarding the technique employed at the Nutrition Laboratory for alcohol check tests, it was thought desirable to meet these requests by reviewing the various techniques in general use and to describe the improved mechanico-chemical device.

#### CONTROL DEVICES IN GENERAL USE

In developing a technique for alcohol checks both the closed and the open-circuit respiration apparatus had to be taken into consideration and, in addition, the various forms of gas-analysis apparatus. For this reason the alcohol checks have been of two kinds and the control devices have varied according to the kind of check carried out.

#### DEVICE FOR CONTROL OF PERCENTAGE MEASUREMENTS BY GAS-ANALYSIS APPARATUS

When, as is frequently the case, the gaseous metabolism apparatus is used primarily to measure the respiratory quotient, the critical part of the apparatus which needs especially to be controlled is the gas-analysis apparatus. In this case alcohol is burned to test the accuracy of the apparatus in determining only the *ratio* between

the carbon dioxide produced and the oxygen consumed, and not the actual *amounts*. The percentage of carbon dioxide in the air expired from the lungs of man is usually about 4 per cent. It is difficult to obtain such a carbon-dioxide percentage, however, in an alcohol check test, for the alcohol flame in the combustion chamber under these conditions is very uncertain. Hence the test of the gas-analysis apparatus of Haldane by this method is beset with many difficulties. The new Carpenter gas-analysis apparatus<sup>9</sup>, however, is capable of measuring accurately smaller percentages of carbon-dioxide and is therefore easily tested by the combustion of alcohol. A small alcohol lamp is placed in the current of air coming from the respiration apparatus and the rate of ventilation of the apparatus is so adjusted as to produce a carbon-dioxide increment in the air of about 1 per cent. For this purpose no particular form of burner or alcohol supply is necessary. A small flask of alcohol fitted with a rubber stopper, containing a piece of glass tubing through which a 10-centimeter length of wicking is drawn, is sufficient. The combustion of alcohol in this small alcohol lamp produces the necessary chemical changes in the current of air to provide for a control of the gas-analysis apparatus, and the ratio of the oxygen deficiency and the carbon-dioxide increment as measured by the gas-analysis apparatus should be very close to the theoretical quotient for alcohol, namely, 0.667. The calculation of such a ratio is given in detail by Carpenter<sup>10</sup>. In this small alcohol lamp it is unnecessary to know either the exact percentage of alcohol or the amount of alcohol burned. One should be reasonably certain that no foreign organic materials are present and that the alcohol is simply pure alcohol plus water.

#### DEVICE FOR CONTROL OF QUANTITATIVE MEASUREMENTS BY RESPIRATION CHAMBERS

The combustion of alcohol is more frequently used for testing the accuracy of respiration apparatus in determining the actual quantitative *amounts* of carbon dioxide produced and oxygen absorbed, and not simply the *ratio* between the two gases. For this purpose it is necessary to know the exact amount of alcohol burned, as well as its composition. This necessitates a method of introducing alcohol into the alcohol lamp in such a way that the amount of alcohol introduced is known either from its weight or by noting the change in level of an accurately calibrated burette which feeds alcohol into the burner.

#### INTRODUCTION OF ALCOHOL INTO BURNER

The simplest method of introducing alcohol into the alcohol burner is by means of gravity feed, a method used many years ago in the respiration apparatus at Wesleyan University, Middletown, Connecticut, and which has been described by Atwater and Benedict<sup>2</sup>. In this case

the exact level of alcohol in the lamp had to be read by a gauge on the side of the lamp, which was inside the respiration chamber some 2 or 3 meters from the observer and at a difficult angle for reading. To overcome these drawbacks the leveling device was brought to the outside of the chamber. A description of this leveling device has already been published<sup>11</sup>. The alcohol burner within the respiration chamber consists of a small capillary tube of Pyrex glass, bent at right angles, in the open end of which can be placed a small bit of asbestos to serve as a wick. The other end of the tube passes through a rubber stopper in the wall of the chamber and connects with a burette and level indicator. Alcohol of known specific gravity and composition is allowed to flow from the burette into the burner, and the level in the indicator outside the chamber is maintained constant. This constancy in level is secured only with difficulty, however, and requires considerable hand regulation, for as the level of alcohol in the burette falls the rate of flow decreases. By admitting the alcohol regularly and more or less continuously into the burette and holding the level in the upper part of the burette approximately constant, this difficulty is somewhat lessened. To introduce alcohol in this way the Nutrition Laboratory has employed a simple form of Mariotte flask<sup>12</sup>. The flask, filled with alcohol, is weighed accurately. Hence the true amount of alcohol introduced into the combustion chamber is found by the change in weight of the Mariotte flask, corrected for any change in level of the alcohol in the burette, which in turn is so controlled by a stopcock at the bottom as to keep the level of alcohol in the index tube always the same. For fairly large respiration chambers this method has proved most satisfactory and is strongly recommended. Here the combustion can proceed almost indefinitely, a second Mariotte flask making it possible to change bottles frequently and not interrupt the rate of flow.

An ingenious procedure for the introduction of alcohol, first employed by T. M. Carpenter in the calibration of a small respiration chamber<sup>13</sup> for infants, consists in the steady raising of a burette. By this means the difficulties of change in level in the burner are entirely obviated, and the amount of alcohol that has been introduced may be read directly on the burette as it is slowly raised. Dr. Carpenter first used a Porter kymograph for raising the burette. In this procedure two important factors must be taken into consideration. In the first place, the size of the burette must vary with the demands for introduction of alcohol, and in the second place, the rate of raising the burette is likewise of importance. Thus, in the calibration of a small apparatus for infants, in which but 1 c.c. of alcohol per half hour needs to be burned, it is obvious that it is necessary to have a burette the cross section of which is small enough to insure accurate readings to 0.01 c.c. A fine micro-burette

delivering 5 to 10 c.c. and graduated to .02 c.c. has been found to be satisfactory. This burette is connected, first, with a small glass reducer, which is in turn connected with the burner by means of a 1-meter length of capillary rubber tubing. The so-called "spectacle bow tubing" is the best to use. This is of white rubber and has an internal diameter of 1 mm. As the burette is raised, the alcohol flows out of it to the burner at a very constant rate.

When one wishes to check the accuracy of a respiration apparatus employed with a human for short periods of about 10 minutes, exactly this leveling device can be used, with a 5- or 10-c.c. burette, but the rate of flow must be increased so as to have the alcohol burned correspond more nearly to 1 c.c. in 5 minutes rather than 1 c.c. in 30 minutes. Frequently, however, it is important to control a respiration chamber which is employed for measuring the metabolism during a series of consecutive half-hour periods. Under these conditions the volume of alcohol which should be introduced per half hour is not far from 6 c.c., and a burette having a volume of at least 50 c.c. is therefore preferable.

**Calibration of burette.** The calibration of a burette is imperative. When a measurement is desired with an accuracy, for example, of 0.01 c.c., the exact delivery of the burette must be known and this can be calibrated in the usual manner by weighing withdrawn portions of distilled water.

**Types of burner.** While the Nutrition Laboratory has employed small copper pipes and used a bit of rather fine copper tubing as a burner, the conductivity of copper is so great that a boro-silicate glass such as Pyrex should be employed. For practically all of the work with adults in the Nutrition Laboratory, in controlling the accuracy both of the small portable apparatus and the respiration chambers, a short length of Pyrex glass tubing with an internal diameter of 1 mm. was used. It is unnecessary to provide for an enlargement of the burner tip, especially when one uses the burette-raising device and does not depend upon gravity for change in level. In this capillary tubing is placed an 8- or 10-mm. length of fibrous asbestos, which serves as a small wick.

#### A MODIFIED MECHANICO-CHEMICAL DEVICE\* COMBUSTION CHAMBER

When the alcohol is to be burned in a closed circuit, but not inside of a large respiration chamber (a chamber large enough to include either an infant or a human), it is necessary to provide a small combustion chamber in which the alcohol can be burned freely. In the mechanico-chemical device of Carpenter and Fox<sup>2</sup> the combustion chamber was a simple glass envelope (actually the external part of a Zuntz respiratory valve), closed at the

top and the bottom with a rubber stopper of a suitable size. The recent development in the Nutrition Laboratory of a method<sup>12</sup> for determining the heat of combustion of organic substances by measuring the oxygen required for burning a definite weight of the substance led to the use of a combustion chamber somewhat larger, but which has proved so satisfactory that it was immediately applied to the control of several respiration apparatus. This combustion chamber (see figure 1) consists of an ordinary lamp chimney, A, although one made of Pyrex glass is more practical. The lower end is placed in a simple water seal, consisting of a brass cup, B, 35 mm. deep and 70 mm. in internal diameter. Extending through the bottom of this cup is a

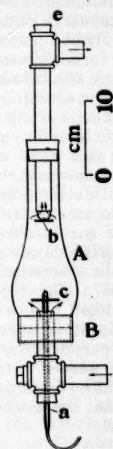


FIG. 1. Combustion chamber. A, glass lamp chimney in water seal in brass cup; B, a glass burner; c, mica disk, and b, baffle plate for protection of flame; e, rubber stopper momentarily removed when introducing oxygen.

brass tube, 24 mm. in diameter, at the bottom of which is screwed a brass cross. In the bottom part of the cross is placed a rubber stopper, through which the glass burner, a, of the alcohol lamp is thrust. One arm of the cross connects with the respiratory apparatus and the other arm can be closed. For many experiments an ordinary tee at the bottom of the cup would serve the purpose, but the three openings in the cross are often found useful. The cup is about one-half filled with water and the lower part of the lamp chimney fits easily into this water seal. In the top of the lamp chimney is placed a one-hole rubber stopper, containing a brass tube 20 cm. long and 15 mm. in internal diameter. To prevent an undue current of air in the lamp chimney a baffle plate, b, is attached to the bottom of this tube. The baffle plate consists of a small brass disk, 38 mm. in diameter, to which a small, flat spring is attached, the expansion of

\*The entire equipment may be obtained from W. E. Collins, 584 Huntington Avenue, Boston, Massachusetts.



the arms of the spring holding the baffle plate in position in the vertical tube. As a further protection for the flame a small disk of mica, *c.*, is slipped over the Pyrex glass burner, but sufficiently above the opening in the brass tube to allow free access of air. Finally, to avoid the possibility of ignition of the alcohol in case it overflows and runs down the tube, and particularly to avoid any danger of ignition of the rubber stopper in the bottom of the cross, a few cubic centimeters of water are usually placed over the rubber stopper.

With this type of combustion chamber the alcohol can be burned at almost any desired rate (indeed at a rate much higher than the oxidative process in a man at rest) without undue heat, ignition, or melting of the rubber tubing. The water seal at the bottom facilitates manipulation, and, as will be seen later in this discussion, this combustion chamber is to be recommended for the control of every type of gaseous metabolism apparatus. Moreover, since it can easily be provided with two ignition wires for igniting substances in an atmosphere of oxygen, this same device is likewise adaptable for the determination of the heat of combustion of various substances<sup>13</sup>.

#### CALCULATION OF THE THEORETICAL AMOUNT OF CARBON DIOXIDE, WATER, AND HEAT PRODUCED IN THE COMBUSTION OF 1 GRAM OF ALCOHOL, AND THE AMOUNT OF OXYGEN INVOLVED IN THIS COMBUSTION

The density of a sample of laboratory alcohol was determined with a good Squibb<sup>14</sup> pycnometer (capable of weighing 50 grams of liquid), and found to be 0.816005 at 20° C. According to the standard density tables of the Bureau of Standards<sup>15</sup>, a liquid comprised of 90 per cent by weight of ethyl alcohol and 10 per cent by weight of water has a density at 20° C. of 0.81797, and a liquid containing 91 per cent of alcohol by weight has a lower density of 0.81529. The difference in density is 0.00268 for a difference of 1 per cent. The density of the alcohol under examination was found to be 0.816005, or 0.001965 below that of the liquid containing 90 per cent of alcohol. The proportion of alcohol in the liquid sampled would therefore be a fraction of 1 per cent greater than 90 per cent, according to the ratio between 0.001965 and 0.00268, or 0.733. In other words, the actual percentage of ethyl hydroxide by weight in the liquid sampled was 90.733.

Since 1 c.c. of this liquid at 20° C. weighs 0.816005 gram, the amount of anhydrous alcohol therein is obtained by multiplying this density by 0.90733, and it is found that each cubic centimeter of this liquid contains 0.7404 gram of pure anhydrous alcohol. From the chemical equation representing the combustion of pure ethyl hydroxide ( $C_2H_5OH + 3 O_2 = 2 CO_2 + 3 H_2O$ ) it can be computed that each gram of

pure ethyl hydroxide, when completely burned to carbon dioxide and water, produces 972.9 c.c. of carbon dioxide, absorbs 1459.5 c.c. of oxygen, and produces 7.08 calories<sup>16</sup>. In the case of the liquid under investigation, which contained 0.7404 gram of pure anhydrous alcohol per cubic centimeter of liquid at 20° C., the amount of oxygen involved in the combustion of 1 c.c. of this alcohol-water mixture is 1081 c.c. (computed simply by multiplying 0.7404 by 1459.5). The carbon dioxide produced equals 720 c.c. (obtained by multiplying 0.7404 by 972.9). The amount of heat involved (found by multiplying 0.7404 by 7.08) equals 5.242 calories.

In the use of the combustion chamber for controlling calorimeters (which measure directly the production of heat), the amount of water involved in the combustion must be considered. The calculation in this case is somewhat complicated by the water pre-existing in the liquid itself, for the heat of vaporization of water plays an important role in the calculation. It is unnecessary to enter into this discussion, however, as in this article we are dealing only with the control of gaseous metabolism apparatus and not with direct calorimetry.

#### BURETTE-RAISING DEVICE FOR INTRODUCTION OF ALCOHOL

The original gravity feed device used by Atwater and Benedict and later in the Nutrition Laboratory is no longer employed, save for the control of respiration apparatus with which experiments are being carried out over a long period of time (12 or more hours) or when a very large amount of alcohol is to be burned. Practically in the control of all the respiration chambers now in use in the Nutrition Laboratory the method of elevating the burette has displaced the gravity feed.

In the experiments as now carried out in the Nutrition Laboratory the subject is rarely inside the respiration chamber longer than 3 or 4 hours. Hence an alcohol check experiment covering this period is sufficient. The burette-raising device is therefore now used in all gas checks. The original method devised by Dr. Carpenter for calibrating the infant respiration chamber involved the raising of the burette by means of a small Porter kymograph, but the total weight of the burette, the alcohol, and the rubber tube, was so small as not to place a very heavy load upon the kymograph. When larger weights are involved, however, as in the use of a 50-c.c. or 100-c.c. burette, it is difficult for the kymograph to handle this load. Many burette-raising devices have been employed in the Nutrition Laboratory, including an electrically driven kymograph, and, as a matter of fact, frequently a small, electrically driven, worm-gear motor. But by far the most satisfactory device thus far found is that illustrated in Figure 2.

This burette-raising device employs the prin-

eiple of a well-known automobile contrivance\* for cleaning the windshield during wet or snowy weather. The windshield wiper, A, is attached in a vertical position to a wooden upright. The actuating mechanism has a small rocker arm, a, which usually carries the appliance for wiping the windshield. A cord rising from this arm passes over a groove in a large wooden pulley, c,

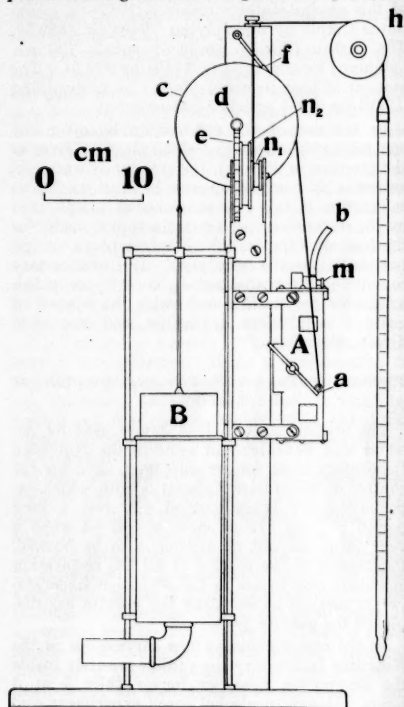


FIG. 2. Burette-raising device for introduction of alcohol. A, windshield wiper with rocker arm, a; b, rubber tubing connecting with vacuum or compressed air line; m, screw to control motion of windshield wiper; h and c, pulleys; B, bell of spirometer acting as counterweight; d and e, worm gears actuating wooden spools,  $n_1$  and  $n_2$ ; f, pawl permitting movement of pulley, c, in only one direction.

and connects with the bell, B, of a small hand spirometer<sup>†</sup>, which acts as a counterweight. The pulley, c, revolves upon a shaft having on one end of it a small worm gear, d, which engages at right angles with the teeth on a larger gear, e, attached to a shaft containing two (or more) wooden spools,  $n_1$  and  $n_2$ . The burette is attached to a cord running over the pulley, h, which connects with the spool  $n_1$ . A small pawl, f, permits the movement of the wheel, c, in only one direction, and by the continual action of the gears

the cord attached to the burette is slowly wound around the spool  $n_1$ . A piece of heavy-walled rubber tubing, b, communicates either with a vacuum or a compressed air line, which serves to actuate the windshield wiper. The motion is controlled by the small screw, m, on the air or vacuum line.

The movement of the large wheel, c, may be so adjusted that one complete revolution will correspond to from 6 to 10 movements of the windshield wiper itself. Obviously the slower the movement the slower the elevation of the burette. On the other hand, by using the spool  $n_2$ , or even a larger spool, any rate of speed may readily be secured. It has been found advantageous to have both the spools,  $n_1$  and  $n_2$ , not too tight on the shaft, so that they can actually be turned by hand to permit rapid adjustment of the burette. Obviously the distance between this raising device and the burette may be as desired. Frequently in the Nutrition Laboratory 2 or more meters of fish line are used. When once set in motion the apparatus functions with the greatest regularity for hours at a time.

While in Figure 2 no connection is shown between the burette and the combustion chamber, obviously when in use the lower end of the burette is connected by a piece of small rubber tubing with the feed tube leading to the burner inside of the combustion chamber. (See Figures 3, 4, and 5.)

This burette-raising device has been used in the Nutrition Laboratory with uniform success for a large number of control experiments with every variety of respiration apparatus. Since each room in the Laboratory has compressed air, most of our tests have been made using compressed air. The windshield wiper can also be used with suction. In all of the alcohol check tests regularly made in connection with the respiration chambers and with the new emission calorimeter at the Nutrition Laboratory, this device for raising the 50-c.c. burette is invariably employed. It likewise lends itself for raising a small, finely calibrated burette in control tests of an infant respiration chamber or small respiration apparatus measuring the metabolism in 10-minute periods.

#### SPIROMETER TO SIMULATE RESPIRATION

To simulate the normal respiration of a human a small spirometer (the exact counterpart of the one originally described by Dr. Carpenter<sup>7</sup>) was used. This spirometer is shown in figure 2, attached to the burette-raising device, and thus far functions solely as a counterweight. When the spirometer is used to simulate respiration, however, the annular space of the spirometer is filled with water to within a few centimeters of the top. Then by raising and lowering the spirometer bell, respiratory movements may be made at any rate desired and of any amplitude. The ordinary amplitude represents 500

\*Made by the Folberth Auto Specialty Company, Cleveland, Ohio.

c.c. per respiration, corresponding to the ordinary volume per respiration of an average man. There are usually not far from 13 to 15 movements per minute.

The outer vessel is 86 mm. in diameter, the inner vessel 70 mm. and the height is 20.5 cm. The pipe extending through the bottom and terminating at the top is 25 mm. in diameter. The internal diameter of the bell is 76 mm., the total length is 20 cm., and the total capacity is not far from 900 c.c.

The length of stroke can be altered by varying the length of the rocker arm as shown on the burette-raising device (a, figure 2). By adjusting the length of cord running over the rocker arm from the pulley to the bell B, so that when the bell is in its lowest position it does not quite rest on the bottom, one has a uniform length of stroke. This is not highly important save in special respiration tests.

In order to count the actual movements of the windshield wiper and its counterpoise, that is, to record the number of simulated respirations in any particular experiment, we have frequently attached to the rocker arm, a, a cord leading to a small Veeder counter fastened to the base of the wooden upright immediately below (not shown in Figure 2).

#### SPECIAL USES OF THE MECHANICO-CHEMICAL DEVICE

The combination of the combustion chamber (as shown in detail in Figure 1), the burette-raising device, and the spirometer makes it possible to control practically any type of gaseous metabolism apparatus with which we are familiar. Moreover it is also possible by means of this device to test the efficiency of various types of respiratory valves.

#### VALVE TESTING

If the rubber stopper, e, in the tee at the top of the combustion chamber (Figure 1) is replaced by a one-hole rubber stopper communicating with a delicate petroleum manometer (in which the index is an oil drop moving in a glass tube bent in the arc of a circle) and if the entire system is then connected with the spirometer and with a pair of valves of any type, the movements of the drop of oil from side to side in the manometer, as the bell rises and falls, give an excellent index of the resistance in the opening and closing of the valves. A large amplitude of oil drop obviously means greater resistance. By connecting the discharge from the expiratory valve with an 8- or 9-liter spirometer and noting the number of movements of the small spirometer required to fill the larger spirometer, one can obtain an excellent index as to the efficiency of the valves<sup>17</sup>. We have commonly used a standard spirometer constructed in this Laboratory, holding a maximum of about 9 liters. By counting the number of strokes of the small spirometer on the burette-raising device

(insuring that the length of stroke is constant) and then noting the rate of fill of the larger spirometer, the efficiency of the valves is instantly noted. The valves which lack efficiency require a larger number of strokes of the small spirometer per unit of volume collected. Not only the relative but also the absolute value of the valves may be determined by measuring the length of stroke of the small spirometer and computing therefrom the volume of air that should be delivered.

#### CONTROL OF OPEN-CIRCUIT RESPIRATION APPARATUS

The types of open-circuit respiration apparatus so commonly employed involve the use of a mouthpiece, mask, or nosepiece, with two res-

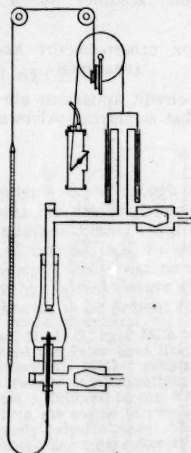


FIG. 3. Mechanico-chemical device connected with open-circuit respiration apparatus employing valves.

piratory valves. One of these valves connects with pure, outdoor air. Through the other the expired air passes either into a dry gas meter, rubber bag, or into a large gasometer, proportionate samples of the expired air being taken for gas analysis. To control this type of apparatus the small spirometer and combustion chamber are used to take the place of the lungs and oxidative apparatus of the human, and are placed between the inspiratory and expiratory valves, as shown in Figure 3, together with the burette-raising device. From the amount of alcohol burned the carbon-dioxide production and oxygen consumption can be computed. This computation serves as a control of the amounts actually measured by the apparatus, based upon the volume of expired air measured by a dry gas meter or in a large gasometer and from the analysis of this air.

## CONTROL OF RESPIRATION CHAMBERS

In the control of respiration chambers the combustion chamber itself is obviously not employed as pictured in Figure 1, that is, the burner may be installed inside the respiration chamber without the lamp chimney and tube with baffle plate. To prevent undue flicker of the flame, however, we frequently do use the combustion chamber as pictured in Figure 1, but remove all connections at the bottom and the stopper in the top to allow the air to pass up freely through the chimney.\* The burette-raising device is of greatest service if attached to a fine-bore burette for the control of an infant respiration chamber and to a 50-c.c. burette for the control of larger chambers for man. Figure 4 shows the general scheme of the set-up for controlling the accuracy of a respiration chamber.

## CONTROL OF CLOSED-CIRCUIT RESPIRATION APPARATUS

The closed-circuit apparatus are of two distinct types, that employing valves and that em-

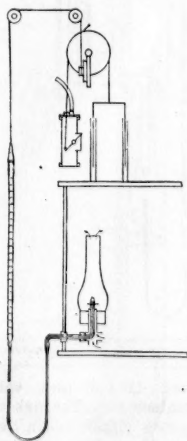


FIG. 4. Mechanico-chemical device connected with a respiration chamber.

ploying a blower to maintain the ventilating circuit without the use of valves. Figure 5 illustrates the general set-up of the mechanico-chemical device with the student respiration apparatus of Benedict and Benedict<sup>18</sup>, i. e., the valve type of closed-circuit apparatus. Precisely the same arrangement is used when the con-

\*If the respiration chamber is of small dimensions, the lamp chimney may be too tall and it may be necessary to cut off the top of the chimney. A piece of mica, rolled in cylindrical form, may be substituted for the lamp chimney or any other device serving to protect the flame from undue drafts of air. In experiments with an emission calorimeter at the Nutrition Laboratory a fine wire gauze or sheet metal hood has been placed an inch above the top of the lamp chimney, to secure better distribution of the heat.

trol device is connected with the valve modification<sup>19</sup> of the Benedict-Collins portable apparatus<sup>20</sup> or with the Krogh apparatus and similar apparatus employing valves.

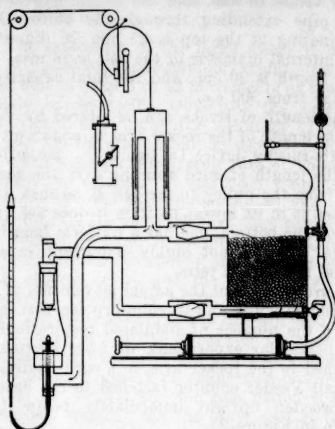


FIG. 5. Mechanico-chemical device connected with the student respiration apparatus.

In those forms of apparatus having a blower to circulate the air, the control apparatus is adjusted exactly as in Figure 3, but obviously no valves are used, and the connections are made directly with the two tubes leading normally to and from the mouthpiece or respiratory appliance. As the ventilation is wholly sustained by the blower in this type of apparatus, the small spirometer attached to the testing device need not be used, save as a counterpoise in the burette-raising mechanism. By connecting the spirometer with the ventilating current of air, however, its action does more closely represent the breathing of man, and if graphic tracings are taken (as is customary with many of these forms of respiration apparatus) the course of the curve of oxygen consumption is somewhat more clearly shown.

The apparatus has been successfully used in testing a respiration apparatus employing neither valves nor circulatory blower, i. e., an apparatus having a rather large dead space.

## SUMMARY

The extensive use of gaseous metabolism techniques makes control of the various forms of apparatus imperative. This is best accomplished by developing in the air current a production of carbon dioxide and an abstraction of oxygen approximately equivalent to that produced by a man at rest. The combustion of known amounts of pure ethyl alcohol in a suitable burner, a combustion chamber, and a ventilating device make such controls possible.



With the mechanico-chemical device of Carpenter and Fox (a modification of which is described) alcohol can be introduced at any desired rate, the normal respiratory movements of a human subject can be simulated, the efficiency of valves can be tested, and both open- and closed-circuit respiration apparatus, including respiration chambers of any size and the various forms of gas-analysis apparatus, can be controlled.

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## ECHINOCOCCUS CYST OF THE SPLEEN\*

### REPORT OF A CASE

BY DOUGLAS BOYD, M.D.

OSLER<sup>1</sup> was the first to draw the attention of the profession to the occurrence of echinococcus disease in America when in 1882 he presented a review of 61 cases drawn largely from his experience at the post-mortem table. Twenty years later a further review, again drawn mainly from autopsy material, was contributed by Lyon<sup>2</sup>, his statistics covering the 240 cases reported in this country prior to 1901, in which nine hydatids of the spleen, or 3.7 per cent. of the series, were found.

Recently Mills<sup>3</sup> collected 200 additional cases from the North American literature, in only three of which did echinococcosis of the spleen occur. To the number he adds four previously unpublished records. Thus it is seen that early in 1924, of a total of 444 reported instances of this disease in America, in only 16, or 3.6 per cent., did echinococcus cysts occur in the spleen.

Statistics of splenic involvement in other countries vary widely, occurring in from 0.78 per cent. of the Iceland cases to 3.7 per cent. of those reported from the Argentine. Deve<sup>4</sup> found 2.3 per cent. of splenic cysts in a large group of over two thousand specimens. In this country the incidence has remained remarkably constant. According to Mills, "Hydatid cysts of the spleen are rare, comparatively so for the world in general, actually so in the case of America."

But if echinococcus disease of the spleen therefore is rare, the reports of surgically treated cases are more so. Cahana<sup>5</sup> in 1917 and Edelman<sup>6</sup> in 1921 have recorded the finding and surgical

removal of splenic cysts, though only in Cahana's case was the diagnosis made before operation. An additional case, which has some unusual points of interest, will be made the subject of this report. There was no suspicion before operation of the true nature of the splenic enlargement known to be present for 30 years.

**CASE RECORD:** M. A. B., aged 55, a widow of English birth, entered the Peter Bent Brigham Hospital April 9, 1924 (Surg. No. 21118), complaining of vomiting of about twenty days' duration. In 1888 she had first noticed a fullness in the left side of the abdomen which in the course of two or three years became a definitely palpable mass. This had slowly enlarged but caused her no symptoms.

In December, 1893, when 26 years of age, she had first come under medical observation at the Massachusetts General Hospital because of a suspected pregnancy. The fundus of the uterus was felt just above the symphysis and the diagnosis was confirmed. Record was made at the time of a prominence in the left hypochondrium, where a large, rounded tumor was felt extending from beneath the left costal margin to the umbilicus (see Fig. 1). Dulness over this area was continuous with splenic dulness; it disappeared after inflation of the colon with air. The tumor was freely movable, descending on inspiration. Tubercle bacilli were said to have been found in the urine and a diagnosis of tuberculosis of the left kidney was made. Operation was considered inadvisable because of her pregnancy. She was discharged and some months later had a normal confinement at the Boston Lying-in Hospital. There the symptomless tumor in the left hypochondrium was again noted, but the presence of tubercle bacilli in her urine could not be verified.

Thirty years after the observations recorded above, the patient first came under our observation because of symptoms relating to the long quiescent though slowly enlarging abdominal tumor.

**Past History:** Born in England, she had come to this country at the age of 21. Here she had married

\*From the Surgical Clinic of the Peter Bent Brigham Hospital, Boston, Mass.

and, as recorded, had a normal pregnancy. For many years she has been troubled with epigastric distress, chiefly at night, and always associated with gas and sour eructations. This was usually relieved by vomiting, such vomitus consisting of food only partially digested. Constipation has been habitual. A normal menopause occurred without complications.

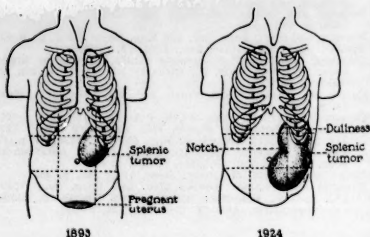


FIG. 1. Diagram of findings in 1893. Compare with Fig. 2.

FIG. 2. Diagram of findings in 1924, 31 years after those shown in Fig. 1.

**Present Illness:** The abdominal mass first caused symptoms three years ago, when there were severe pains in this region for a week. She had no further difficulty until 25 days before admission, when there was a period of dysuria. Shortly after, she experienced a dull, aching, non-radiating pain in the left loin, relieved by local applications. She however began to vomit and has continued to do so for the past two weeks and has lost much weight—from 135, her normal weight, to 119 pounds. Rectal feedings have been necessary.

**Physical Examination:** The abdomen was slightly distended, soft, and tympanitic in the flanks. In the left upper quadrant a large, smooth, rounded mass which moved with each respiration was easily felt. It was tender on pressure. The mass extended downward beyond the midline and almost into the pelvis, but seemed not to be connected with any pelvic organs (see Fig. 2). There was no demonstrable enlargement of the liver, nor could the right kidney be felt. Pelvic examination revealed only a small atrophic and retroverted uterus. At the bases of both lungs a few fine, crepitant rales were heard, more pronounced in the left base. The heart was slightly enlarged, with a systolic murmur at the apex. Pyelograms on this left side showed slight dilatation of the renal pelvis.

**Laboratory Findings:** Temperature, pulse and respiration were normal. Her white blood count was 11,000, red blood count 5,000,000, hemoglobin 100 (Talquist), and the blood smear showed 2 per cent. eosinophiles. Numerous white blood cells were found in the urine. Phthalein excretion was 60 per cent. in two hours.

On cystoscopic examination the bladder and ureteral orifices appeared normal. On the left side the catheter was passed up the ureter for about 12 cm. when it buckled and could not be inserted further. A very slow flow of cloudy urine appeared from this side. The urine from both the left and the right kidneys was cloudy and infected with *B. coli*.

The X-rays revealed a moderately enlarged left kidney. Occupying the whole left flank and extending into the pelvis, a large dense mass was seen, on one side of which there was a faint rim of calcification. Lying over the sacrum was another large circular mass 6 cm. in diameter, which was thought to be a calcified uterine fibroid. Barium enema showed a normal large bowel. **Diagnosis:** Splenomegaly; fibromyoma of uterus.

**Clinical Course:** At entry the patient was unable to retain food or fluids, but after saline and glucose solutions were given by rectum and beneath the pec-

toral muscles at intervals for eight days she showed marked improvement and her vomiting ceased.

The feeling of the Staff at this time was that the mass was a splenic tumor of unknown etiology. There was no suspicion of its actual nature, for otherwise complement fixation tests would have been made. Sir D'Arcy Power was at this time acting as Surgeon-in-Chief, and he advised an exploratory operation, which he conducted with the assistance of Dr. John Homans 14 days after the patient's admission.

**Operation:** April 23, 1924. Under ether anaesthesia, a left rectus incision revealed a large, tense cystic tumor lying behind the gastrocolic omentum and adherent to it. When thoroughly freed from these adhesions, it was apparent that there was



FIG. 3. Photograph of the tumor after removal (nat. size). Note the raw splenic tissue which caps the upper pole.

splenic tissue covering the upper pole of the cyst where it spread out like a cap in a thin layer over the surface. The spleen above the cyst appeared to be enlarged, though normal in color and consistency. Palpation of the pelvis showed a normal atrophic uterus, closely applied to the bladder, with no tumor masses associated. The liver was not seen. The cyst was dissected out of the splenic tissue with considerable persistent bleeding. This was finally controlled to a large extent by transfixing sutures of chromic cat gut passed with a large needle. The raw area was lightly packed with two cigarette drains with large projecting gauze ends, which effectively controlled the oozing. The wound was closed in the usual manner, the drains emerging from the upper border.

**Postoperative Course:** The patient made a good recovery. There was not enough oozing to stain the dressing and the drains were removed early. By the 19th day she was out of bed, and on the 29th day was discharged. During the convalescent period, complement fixation test for hydatid disease was twice negative.

**Subsequent History:** The patient reported for examination on July 29, 1925, a year after her operation. She has remained free from all abdominal

symptoms, weighs more than for years, and has been earning her living as a chamber maid. Further X-ray studies of the abdomen show that the secondary carcercous nodule in the pelvis remains unchanged. At the time of her admission this was thought to be a calcified fibroid, but it was not disclosed at the time of her operation. It now appears evident that it is a calcified tumor in the mesentery of the sigmoid, undoubtedly a quiescent echinococcus cyst which gives no symptoms.

**Pathological Report:** (Dr. S. B. Wolbach.) "The specimen (Fig. 3) is a large cyst removed from the spleen. It is roughly egg shaped, somewhat constricted near its smaller end, weighs 1250 grams and measures 18 x 13 cm. at its greatest diameter. The surface is covered with peritoneum except an area at one side, 12 cm. in length and 5 cm. in width, where it has been separated from the spleen, and to this area some splenic tissue remains attached. The wall of the cyst is thick and dense. In areas there are large calcified plaques. A large part of the wall was found to be covered with splenic tissue. The cyst had apparently derived an additional blood supply, as, some distance from the portion which was attached to the spleen, several large vessels were seen spread over the surface and entering the capsule. The wall was found to be composed of two layers, the outer one being somewhat thicker than the inner, together measuring 4 mm. in thickness. From a small nick a quantity of glassy, gelatinous material was expressed with very little free fluid. When this was placed in normal saline it readily assumed cystic shapes. Examined microscopically, this material was found to have structures characteristic of an echinococcus cyst." The specimen is in the permanent collection of the Warren Museum of the Harvard Medical School.

**Comment.** This patient was known to have borne the splenic tumor for thirty years, during which time she had surprisingly few symptoms. Most writers agree that the cysts develop insidiously and cause little or no discomfort until they reach such a size as to interfere with function of adjacent organs.

Symptoms and physical signs associated with this condition in the reported cases are consistent but by no means distinctive. The outstanding symptom is usually an abdominal tumor which annoys the patient because of the sensation of weight or a generalized abdominal distress or pain after eating, and sometimes vomiting. A history of close association with animals, particularly dogs in sheep-herding countries, may often give a suggestion for the diagnosis, the particular laboratory aids for which are:

(1) An eosinophilia; (2) the complement fixation test; and (3) a cutaneous test proposed by Magath<sup>7</sup>. The finding of only 2 per cent. eosinophiles in one patient's blood smear was not distinctive, and the complement fixation tests made after her operation, when, as now appears, a second cyst was present in her abdomen, were negative.

In the case above described the diagnosis remained obscure because the patient has never lived on a farm and denies having ever had any contact with dogs or any animals as pets because she does not care for them. She was born in England, where the disease is rare, and migrated to this country at the age of 21 years, and one year later the splenic tumor was definitely noticed. The larger number of cases reported in this country are in foreigners, particularly in those who come from Iceland, Australia, Italy, certain portions of Germany, and other districts where man is brought into close contact with the dog.

It is not known how long the echinococcus remains alive, but very likely many years, perhaps 20 (Osler). There appears to have been little actual growth of this cyst over the period of years between observations. The tumor had gravitated farther into the pelvis, corresponding to the type which Dieulafoy<sup>8</sup> has called the descending type of splenic hydatid, in contrast to the other group of splenic cysts which press upward, elevating the diaphragm. There seems little doubt that a considerable part of this extension downward was due to hypertrophy of the spleen. Why this growth should have caused symptoms after such a long period of quiescence must remain a matter for conjecture. No abnormality sufficient to cause obstruction could be demonstrated in the intestine.

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## TRANSACTIONS OF THE NEW ENGLAND BRANCH OF THE AMERICAN UROLOGICAL ASSOCIATION

THE forty-sixth meeting of the New England Branch of the American Urological Association was held as an all-day clinical meeting with the regular meeting at the Harvard Club in the evening on April 8, 1925.

Interesting clinics were contributed by the Massachusetts General Hospital and the Peter Bent Brigham Hospital. Dr. A. H. Crosbie demonstrated cases of regional anesthesia at the Naval Hospital in Chelsea.

Dr. George Gilbert Smith of Boston and Dr.

Edwin Gardner of Fall River reported cases of carcinoma of the ureter.

Dr. Oswald S. Lowsley of New York read a paper on Kidney Operations Under Regional Anesthesia, illustrated by moving pictures.

Dr. J. G. Anderson of New York, who is the anesthetist in most cases of regional anesthesia in Dr. Lowsley's clinic, gave interesting details of the demonstration of regional anesthesia.

The Society extended a vote of thanks to the

Massachusetts General for the luncheon provided by the Hospital.

Meeting adjourned.

E. GRANVILLE CRABTREE, M.D.,  
*Secretary-Treasurer.*

The meeting was called to order by the President, Dr. W. W. Townsend, at 8:30 P. M.

The Secretary read the record of the minutes of the last meeting (from ms.).

There being no errors or omissions noted the minutes stand approved as read.

THE CHAIR (Dr. Townsend): The following names have been proposed for membership (reading five names). These names were referred to the Executive Committee and will be voted upon at the next meeting.

DR. TROWBRIDGE: I would like to move that this Society give a vote of thanks to the superintendent of the Massachusetts General Hospital for his courtesy and hospitality in providing the lunch.

Motion seconded and carried.

#### PRESENTATION OF SPECIMENS AND REPORTS OF CASES

DR. G. G. SMITH: This was to me a very interesting case—a man, 67 years old, in apparently perfect health. A week before he had noticed hematuria. He had had slight frequency for about six months. I cystoscoped him. His bladder was normal. His prostate didn't appear enlarged, but the right ureter looked as if it were elevated. It ran through the base of the bladder as if it were full of something; and out of the mouth of it projected a tumor which stretched up the mouth of the ureter. I took him to the hospital and tried to pass a catheter up that side but could get nothing through the tumor. I found his other kidney was normal. The problem came up—what was the best thing to do? I figured that he had a carcinoma of the lower end of the ureter, and knowing that primary tumor of the lower end of the ureter was rarer than tumor of the kidney or pelvis, I thought it was a transplant from a tumor up in the kidney or pelvis. However, there was no way of doing a pyelogram, and I reasoned that if I cut down on the kidney, even if it were normal, I would be unable to say whether there was a tumor in the pelvis. So it seemed to me that the only proper procedure—one that was radical—was to take out his kidney and the entire ureter and the portion of the bladder into which it went. So this was done. I gave him scopolamine and spinal anesthesia and removed his kidney, which appeared perfectly normal. The spinal anesthesia worked very well except that he had to have a whiff of gas during the ligation of the pedicle. Then I turned him over and made a mid-line incision. First I picked up the ureter and pulled it down from above, then opened the bladder and took out an elliptical piece of the bladder and the stump of the

ureter. Examination showed the kidney to be normal and the entire ureter to be normal except for this tumor in the lower end (showing),



Drawing of lower end of Ureter, split longitudinally, showing Primary Carcinoma. Case reported by Dr. G. G. Smith.

which the pathologist reported to be a rapidly growing carcinoma. The patient made good recovery.

DR. EDWIN GARDNER: Apropos of this case of Dr. Smith's, I would like to report a similar case, which I operated upon about a year ago. This tumor was in the ureter about half way between the bladder and the kidney, and I was in a quandary whether to remove the kidney or not, but finally decided I had better, because there might be a papilloma of the kidney and the one in the ureter a transplant, and also, because the tumor extended over fully two inches of the ureter, which would make it difficult to resect the ureter and do an anastomosis. Therefore I took the kidney and ureter out, and it proved to be a primary carcinoma of the ureter.

DR. TOWNSEND: I think a vote of thanks should be extended to the Secretary for arranging such a delightful program as he has arranged for us, and then as a fitting climax for the guest of honor this evening, Dr. Lowsley is known to us all for the work he has done on the prostate, and which made him famous, and I am sure he is going to add to his fame by giving us something on regional anesthesia. I have the pleasure in introducing Dr. Lowsley of New York.



Dr. Oswald S. Lowsley, New York, read a paper on "Kidney Operation Under Regional Anesthesia" (from ms.) and showed moving pictures.

## OPERATIONS UPON THE KIDNEY UNDER PARAVERTEBRAL ANESTHESIA

MOVING PICTURE AND LANTERN SLIDE DEMONSTRATION

BY OSWALD SWINNEY LOWSLEY, A.B., M.D.  
F.A.C.S.

*From The James Buchanan Brady Foundation  
for Urology, of the New York Hospital*

### INTRODUCTION

The utilization of regional anesthesia for kidney operations has not been taken up with avidity by large numbers of surgeons of any country. The surgeons of America and Great Britain seem to be most deliberate of all in appreciating the great advantages of this type of anesthesia.

Hugo Sellheim published extensive experimental works in 1905 on his studies in abdominal surgery. He deserves credit for originating regional anesthesia. Six years later Lawen performed the first kidney operation at the University Clinic at Leipsig. Paravertebral anesthesia was instituted in many of the Clinics of Europe. It was most popular in Germany and Austria. A complete history of this development has already been published by us and will not be repeated here.

In this realm of urology the most extensive work has been done in the Clinics of Prof. Illyes at Budapest. Stimulated by the splendid results obtained there the Urologic Department at the New York Hospital began doing operations upon certain kidney cases under paravertebral anesthesia in the fall of 1923.

It soon became apparent that those cases operated upon by this method had a much easier convalescence and were so much better in every regard that it has now become a routine method of procedure and every kidney case is operated upon under regional anesthesia.

### PRE-OPERATIVE PREPARATION

After a diagnosis has been established the patient is given sodium Bi-carbonate for a period of 48 hours before operation unless there is some counter-indication.

Purgation is instituted the day before operation so that the patient may enjoy a good night's sleep and not be subjected to a last minute dehydration. In fact the period before operation is devoted largely to forcing fluids. One of the greatest advantages of a non-inhalation method of anesthesia for Urologic cases is that the patient may take fluids up to, during and immediately after the operation.

### MORPHINE

At the suggestion of Dr. J. Gordon Anderson, our expert on regional anesthesia, we have eliminated Morphine and all other narcotic drugs as preliminary to Urologic operations. We find that it is an entirely unnecessary adjunct. It is a tremendous advantage to do without it because one eliminates stasis of the bowels as well as temporary interference with the secretion of urine.

It is a great advantage for the patient to be located in a department where all the other patients are being operated upon by the same method. Word gets around among them and they all seem pleased when they have gone through the operation without taking any ether, essence of orange or ammoniac ammonia. To the nervous patient one is as good as the other for them to smell, but when a patient is really hurt we unhesitatingly give a little ether. Never in the hardest case have we ever given more than one ounce of ether for the entire operation.

### SOLUTION USED AND ITS ADMINISTRATION

We feel that there is a great room for improvement in the solutions used for inducing regional anesthesia. Up to the present time we have found freshly dissolved Procain which has been boiled just before operation to be the least toxic and most effective substance used thus far. One gramme per 100 pounds of body weight should be the maximum amount of the drug used. Tutocain, a drug recently introduced, is reputed to have  $\frac{1}{2}$  the toxicity of the procain and to be as effective as an anesthetic. It may prove to be valuable.

Our own attempts to introduce an anesthesia agent less toxic than procain resulted in a synthetic product made by dissolving 12 grammes of the Ethyl ester of P-aminobenzoic acid (Benzocain) and 18 grammes of the methyl ester of M-amino-P-oxybenzoic acid in syrup of dextrose sufficient to make 100 c.c. This substance is 1/40 as toxic as cocain, as proved by experiments on rats after the method of Hatcher and Eggleston. The anesthetic quality was entirely satisfactory but the product is so unstable as yet that we have been unable to use it except in a solution mixed as above immediately before use. This is obviously impossible to accomplish. We are unalterably opposed to the use of epinephrin as an accessory to any type of regional anesthesia. It has a direct action upon the sympathetic nervous system. 0.5 c.c. of 1:1000 solution of epinephrin given subcutaneously in a normal individual causes a rise in blood pressure of 10 to 20 mms Hg. which lasts for at least ten minutes. This is accompanied by an acceleration of the pulse and a sense of nervousness. To a person about to undergo an operation this frequently causes a palpitation and period of excitement which is

more terrifying than a certain amount of pain. Then, too, one must constantly be on the lookout for the patient with a slight amount of hyperthyroidism. Emil Goetsch has shown that such a patient is particularly sensitive to epinephrin and that a few minims will elevate his blood pressure by 50 to 100 mm. Hg. Such a wild state of excitement is produced that all idea of performing an operation is eliminated.

Those who advocate its use believe that it causes a slow absorption of the solutions. This opinion is differed with strongly by Dr. Murray Lyon of the University of Edinburgh (*Journal of Experimental Medicine*, Dec. 1, 1923; Vol. XXXIII, No. 6, page 655), who states: "The impression seems to be widely prevalent that adrenalin given subcutaneously causes little general effect and its action is quite uncertain. This view is probably based on the blanching of the skin which is seen around the site of injection and on the fact that adrenalin causes vasoconstriction of some vessels. But the spectacular relief from distressing symptoms that occur in asthmatics within a few minutes after a hypodermic injection of a minute dose of adrenalin has been given is in itself evidence that absorption by this route is rapid and satisfactory. It is suggested that absorption can take place freely by lymphatic channels."

#### TECHNIQUE OF ADMINISTRATION OF PROCAIN

Upon the arrival the patient is taken directly to the anesthetic room and a special nurse assigned to be present until the surgeon is ready to proceed. All evidences of haste, flurry, or active preparation are shut out.

When all is ready for the administration of the anesthesia the patient sits on the table with feet on a support. The hands rest on the knees or on the shoulder of an attendant who sits in front of the patient. The back is bent slightly forward and the head lowered. This position throws the bony parts concerned into most prominence and is maintained while the first part of the anesthesia is given. It can be administered with the patient lying on the opposite side, but this is not suitable.

Starting at a point a little below the 12th costo-vertebral angle and about 2 cm. from the midline a long wheal is raised by the injection of 1% procain. This infiltration extends from the original point to the level of the 8th rib. A point opposite the spine of the 7th dorsal vertebra and 2 cm. from the midline is selected. A carefully tested needle is then inserted until it strikes the angle formed by the lamella on that side and the transverse process, it is then pushed over the edge of the bone and the point deflected inward and the needle again inserted for a distance of about 1 cm. This brings the point of the needle into the area occupied by the merging nerve roots. Suction is put upon

the syringe to make sure that the point of the needle is not in a blood vessel and then 2 or 3 c.c. of 1% procain solution is injected into the region. This is repeated at the 9th, 10th, 11th and 12th dorsal vertebrae. The angle formed by the 12th rib and the vertebral column is filled quite thoroughly both superficially and deeply with the solution, all injections taking their origin from the original wheal. The patient is then placed on the opposite side in a comfortable lying position. Injections are made into the skin, subcutaneous and muscular tissues of the entire loin with 1/2% procain. All of these injections take their origin in the preliminary wheal so that the only pain the patient feels is one needle prick at the beginning of the infiltration.

It is very important to avoid pain in the administration of the anesthesia because the average patient will be much more coöperative if this is successfully given. It is hard to convince the patient that no pain will result from the cutting operation if the administration of the procain is uncomfortable. It has been our custom not to give more than 150 c.c. of 1% procain (1.5 gm.) or its equivalent to the average sized man.

It has always been possible for us to proceed with the operation as soon as the patient is in position and properly prepared and draped.

When we approach the intervertebral foramen care must be used not to exercise too much pressure as it is at this point that toxic symptoms with absorption of the drug may occur. Neither is it a necessity to have the fluid penetrate the foramen of each of the nerves as pressure at the sill of the foramen seems sufficient to produce the desired anesthesia. Raising and lowering the needle alternately at the sill of the intervertebral foramen assures a better distribution of the anesthetic and is important. The vicinity of the 12th nerve, lying as it does below the rib and having a tendency to spread, should receive a little more anesthesia than the nerves above.

The successful carrying out of this technique should give us a complete anesthesia of the posterior lateral and enough of the anterior abdominal wall to allow any of the modern kidney incisions to be made. It is rarely possible to obtain a peritoneal and abdominal anesthesia as well.

It may be well to repeat that the anesthetized areas should be tested out before we start on an operation. It is also advisable not to ask the patient if he feels pain. If it is present he will promptly communicate the fact with you. If he is asked regarding sensation he is prone to become hypersensitive. An eminently wise precaution that should not be overlooked is the screening off of the field of operation from the patient's view. The well nurtured patient often expects to experience pain and this being so, one finds that painful sensations are often ab-

sent when the manipulations of the surgeon are invisible to the patient. The presence of a physician or a well trained nurse to keep the patient's mind diverted from the operative field is a most valuable asset in this technic as in other local or regional procedures.

The method which we have described seems to have several advantages over the older ones. In fat or heavily muscled individuals it is extremely difficult to locate the rib at the point usually recommended on account of the fact that there is a tremendous amount of tissue between it and the skin. By the method described above, however, it is always possible to locate the angle formed by the transverse process and the lamella of the vertebra and that allows the injection to be made in the proper place in all the cases.

It is considered particularly important to conduct the entire injection with only one prick of the needle. The patient immediately feels that he will be carried through without pain and the fact that the injection is practically painless serves as a tremendous psychological boost.

#### OPERATION

Experience teaches us that careful sharp dissection will not cause discomfort while any rough treatment is liable to be accompanied by pain. Therefore the scalpel is used freely even in separating muscle bundles. The incision is made larger than is ordinarily the case in order to render heavy retraction by assistants unnecessary. Satisfactory retraction is entirely possible but sudden movements of any sort are liable to cause complaint.

The incision is invariably a painless procedure. The separation of the kidney from its surrounding adhesions however requires special treatment. We have learned that if one avoids any manipulation upon the front or peritoneal surface until the remainder of the organ has been freed there will be less pain connected with this part of the operation.

The ureter is usually isolated without much difficulty or pain. Most writers on the subject lay great stress upon the amount of pain caused by clamping the pedicle. It is our experience that this act seldom results in pain. Should pain follow it is easily controlled by injecting some solution into the tissues forming the pedicle.

#### RESUME CASE OF LOUISE BONNEY TUBERCULOSIS OF RIGHT KIDNEY

Patient was an undernourished single woman thirty years of age who came in complaining of intermittent pain and soreness in the abdomen, more pronounced in region of right kidney—duration four months.

**Family History:** Mother has ptosis of one kidney. Her maternal grandmother, one maternal uncle and one cousin died of tuberculosis.

**Past Personal:** For the past six years patient has had active pulmonary tuberculosis. She had

occasional hemorrhages during this time. She has not had a hemorrhage for the past four years and she thinks that the process in her lung is not very active.

**Present Illness:** Four months ago a cystitis began—there was frequency and painful urination, this lasted about three weeks and since that time there has been intermittent attacks of dull aching pain in the right kidney region. Six weeks ago the patient noticed that she was growing weaker and it soon became impossible for her to do her work or even to stay out of bed more than a few hours at a time. Each attack of pain in the kidney region was accompanied by constipation.

**Physical Examination:** A summary of the physical examination is:

1. *Extreme tenderness over right kidney and slight tenderness over the transverse colon.*
2. *Emaciation.*
3. *Crackling rales and a small cavity in the left apex of the lung.*

**Cystoscopy Findings:** Revealed a clear urine from both kidneys. Phenol-Sulphone-Phthalein appeared on the left in six minutes and 18% was excreted ten minutes after the appearance. No Phenol-Sulphone-Phthalein appeared on the right.

#### LOUISE BONNEY

Microscopical findings showed much pus from the right side and only an occasional epithelial cell from the left.

**X-Ray and Pyelogram (right):** Right kidney shadow was large, extending from lower border of the 11th rib to a point one inch above the crest of the ilium. Left kidney shadow is normal in size and location. No evidence of stone anywhere in the urinary tract.

**Pyelogram (right):** Shows a tremendously enlarged pelvis with almost complete obliteration of the calices.

**Suggestion:** In view of the fact that there is no P. S. P. and very little urea from the right side and a sufficient quantity on the left—it is suggested that this patient have her right kidney removed under regional anesthesia.

**Operation:** Patient operated on two days after admission—kidney removed under regional anesthesia. There was no special difficulty encountered during the operation. Patient returned to her room in good condition and her blood pressure showed a drop of only nine points. She had very little pain during the night.

Her wound healed by first intention. The patient gained about four pounds in weight in one month and a month after the operation she was discharged feeling better than she had felt in several years and some of her color which she had in childhood had returned.

**Pathological:** For some reason the artist mislaid the specimen and when the pathologist gained possession of it—it had deteriorated so

much that he could not say much about it more than that it was distended with pus and that it was in a decomposed state.

However, a guinea pig inoculated with a cath-

which radiates to the bladder. There is nothing in his history of any importance except that this pain has been intermittent and accompanied by frequency for about two years.

## SUMMARY OF RESULTS

## KIDNEY OPERATIONS UNDER REGIONAL ANESTHESIA

Dr. O. S. Lowsley, A.B., F.A.C.S.

Name	Age	Days in hos- pital	Diagnosis	Operation	Result of anesthesia	Post- operative note
Chas. Crouse	29	61	T. B. left kidney	Nephrectomy	100%	No shock
Nick Casucci	34	23	T. B. right kidney	Nephrectomy	85%	" "
Jas. Creegan	51	39	T. B. right kidney	Nephrectomy	95%	" "
C. Cafarelli	60	96	T. B. left kidney	Nephrectomy	100%	" "
Grace Clark	58	62	Right nephroptosis	Nephropey	95%	" "
Geo. Flackofsky	44	20	Calculus left kidney	Nephrectomy	85%	" "
Cath. Brahan	48	22	T. B. right kidney	Nephrectomy	100%	" "
A. Greco	41	17	Right nephroptosis	Nephropey	90%	" "
C. Hartnett	30	24	T. B. right kidney	Nephrectomy	75%	" "
F. Goldman	51	33	T. B. left kidney	Nephrectomy	90%	" "
Morris Izak	62	25	T. B. left kidney	Nephrectomy	95%	" "
Jennie Lapiano	34	39	Calculus left kidney	Pyelotomy	90%	" "
Louis Mai	47	42	Congenital malfor- mation of bladder	Right nephrotomy	90%	Shock
Henry Selmer	36	32	Right pyonephrosis	Right nephrotomy	90%	Slight shock
Mrs. H. Wilson	32	23	Left nephrolithiasis	Pyelotomy	95%	No shock
H. S. Beardsley	47	29	Left pyonephrosis	Nephrectomy	85%	" "
Jos. A. Flinn	54	23	Left hydronephrosis	Pyelotomy for ab- scess and drainage	100%	" "
Mary Smith	37	19	Haematuria	Left nephrectomy	85%	" "
U. Notarile	31	19	Right nephroptosis	Nephropey	98%	" "
Chas. Stein	31	17	Calculus left kidney	Pyelotomy	90%	" "
Mrs. H. Simon	66	36	Calculus left kidney	Nephrectomy	85%	" "
Anna Samperi	32	3	Bilateral polycystic kidneys	Right nephrotomy	90%	" "
John O'Reilly	47	19	Right pyonephrosis	Nephrectomy	95%	" "
Jacob Berman	42	29	Left pyonephrosis	Nephrectomy	80%	" "
John Wansor	54	54	Hypernephroma	Right nephrectomy	95%	" "
Robt. K. Wylie	21	34	T. B. right kidney	Nephrectomy	65%	" "
Lena De Laura	26	26	Right pyonephrosis and left ectopic kidney	Nephrectomy	80%	" "
Geo. Flackofsky	44	19	Right nephrolithiasis and chronic right pyelitis	Pyelotomy	90%	" "
Mary Perkins	57	22	Right hydronephrosis	Nephrectomy	100%	" "
Mr. Dazreck	43	36	T. B. left kidney	Nephrectomy	90%	" "
Jos. Flinn	54	17	Left ureteral stone	Ureterotomy	100%	" "
J. Fennelley	56	43	Right hypernephroma	Nephrectomy	100%	" "
Louise Bonney	32		T. B. right kidney	Nephrectomy	100%	" "
Mrs. Woodworth	34		T. B. right kidney and perinephritic abscess	Incision and drainage	100%	" "
D. Fevessi	41	19	Calculus left kidney	Pyelotomy	90%	" "
W. Mitchell	36	19	Calculus right kidney	Pyelotomy	90%	" "
Geo. Sipperley	31	5	Calculus left kidney	Pyelotomy	95%	" "
Celia Bleacher	34	18	Calculus left kidney	Pyelotomy	100%	" "
C. Pancaldo	45	18	Calculus left kidney	Pyelotomy	100%	" "
Charles Presti	23	16	T. B. right kidney	Nephrectomy	100%	" "
F. Dingfelder	31	27	T. B. right kidney	Nephrectomy	90%	" "
A. Rizzo	27	25	T. B. right kidney	Nephrectomy	100%	" "
S. Johnson	40	30	T. B. left kidney	Nephrectomy	95%	" "
C. John	33		T. B. right kidney	Nephrectomy	90%	" "
G. Casso			Right nephrectomy			
J. Suchowski	35		T. B. right kidney	Right nephrectomy	100%	" "

eterized specimen from the right kidney was found six weeks later to have active tuberculosis.

RESUME OF CASE OF ANTHONY RIZZO  
TUBERCULOSIS OF RIGHT KIDNEY

Patient is a well nourished but pale Italian who complains of pain in right kidney region

**Physical Examination:** Reveals a palpable mass in the right kidney region which is tender to pressure. The patient has a cold and rales are general thruout the chest. It could not be distinguished whether the rales were due to temporary inflammation or to a chronic affair.

**Cystoscopy Findings:** Showed right side



urea—2 grams per Litre. Phenol-Sulphone-Phthalein output appeared in five minutes and was 6% ten minutes after the appearance time.

*Left Side:* Urea 6 gms. per Litre. P. S. P. appeared in five mins. 15% ten minutes after appearance time.

Microscopic examination showed numerous pus cells from the right and only blood cells from the left.

*X-Ray and Pyelogram (right): G. U. Tract—*Right kidney shadow is large and low. Left kidney shadow is normal in size and location. There is no evidence of stone anywhere in the urinary tract.

*Pyelogram Right—*Shows an excavation of the right kidney. Right ureter is thickened thru-out.

*Suggestion—*It is suggested that this kidney be removed in view of the fact that it is entirely excavated, great diminution in function and also the probability that it is tuberculous.

*Operation:* Right kidney was removed under paravertebral anesthesia three days after admission. No special difficulty encountered during operation. Patient returned to his room in good condition. His blood pressure shows a drop of 6 points. He had some pain during the night but was controlled with Morphine. His highest temperature after operation was 101 by mouth, four hours after operation, this gradually subsided until it reached normal on the 19th day; most of the time his temperature was 99.4. The wound healed by first intention.

Alpine light was shined on the wound daily. Patient appeared to have gained weight though he was not weighed. He walked out of the Hospital on the 24th day in excellent condition.

*Pathology:* Tubercles and caseation were well distributed thruout the specimen and there were only patches of normal parenchyma. The pelvis was lined with granulation tissue.

#### CONCLUSION

Our brief experience with regional anesthesia as a method for the performances of operations upon the kidney leads us to believe that its general employment is inevitable and marks a milestone in the advance of surgery of the kidney.

*Among its advantages are:*

(1) It is possible to do the average operation painlessly.

(2) The patient is able to take fluids without cessation during the entire procedure.

(3) There is no elevation of the blood pressure, therefore there is less bleeding than with any inhalation anesthesia.

(4) The area operated upon remains anesthetized for 6 to 8 hours thus allowing the patient to emerge from the post operative slump period before any sensation of pain is felt. This fact coupled with the slight hemorrhage involved eliminates the probability of shock.

(5) The administration of regional anesthe-

sia is not the surgeon's job. It should be done by the anesthetist, who in my opinion should be able to give any kind. In fact he should advise us as to which type is best for the patient and not for his own convenience.

#### DISCUSSION

DR. A. H. CROSBIE, Boston: I am sure we are all very much indebted to Dr. Lowsley for his most interesting and instructive paper. I feel especially grateful to him for stimulating me to use this form of anesthesia. I have always felt very strongly that in our genitourinary work the more we could get away from general anesthesia the better; and most of us for prostates have done away with it, but in the kidney work occasionally I have done a nephrostomy under a purely local anesthetic but I haven't gone ahead and tried to do any radical operations on the kidney under novocaine. This past winter I began thinking about it and I wrote Dr. Lowsley. He invited me to come over, which I did, and I was much impressed by it. When I came home the first case I did under it worked beautifully. This was a nervous old lady on whom I did a nephrostomy, and she didn't suffer any pain. The next two cases didn't work well; I had to supplement them with ether, but in these two I discovered that the novocaine was old, and as Dr. Lowsley has told us, we must use fresh novocaine. I was told it was a novocaine produced during the war, and the crystals were yellow, and it made a yellow solution. So then we got new novocaine and it has worked better. I have used it on 14 cases since visiting Dr. Lowsley and in only four of those have I had to supplement with ether. We did two this morning, one a nephropexy and the other a removal of a stone from the kidney; and both of them worked very well. We did not supplement with ether in either of them. Freeing the peritoneum from the anterior part of the kidney did cause a little discomfort. I feel very strongly that it is a technique that either we surgeons or our anesthetists if we have them, must learn to use.

Of course, a great many of the cases we operate upon can perfectly well stand a general anesthetic; but when you come to these special cases as tuberculosis I think it is tremendously important for us to know the technique so that we can avoid a general anesthetic.

DR. J. D. BARNEY, Boston: I have had no experience with paravertebral anesthesia such as Dr. Lowsley has described but I have operated on a number of kidneys under spinal anesthesia and under local novocaine anesthesia. They have been successful as far as the anesthetic effect was concerned. The patients did complain of the position in which I put them,—the position we have to put them in to work properly—that is, they were bent over a table in such a way as to produce curvature of the spine. They did complain of that position but not of the operative

procedure. I would like to ask Dr. Lowsley if there has been any complaint of the patients as regards this position.

I would like to ask him also if he would go ahead with one of those kidneys which are very densely adherent which it would require a great deal of manipulation to loosen up; those cases with a thick pedicle where there must be pulling and traction to deliver them at all.

And then I would like to ask him if he would tell us what would happen in the cases of accident where we lose a pedicle or have a renal vein tear, where pulling must be done in order to recover the bleeding vessel—whether the patient would stand, the pulling required and whether he could give ether quickly enough to accomplish the desired results.

DR. A. H. CROSBIE, Boston: As it happens, the case I saw Dr. Lowsley do was one of these difficult ones which Dr. Barney mentioned; I cannot imagine a more adherent kidney—adherent everywhere—and the anesthetic worked beautifully though they did give him a few whiffs of ether.

DR. R. F. O'NEIL, Boston: I was very much interested in Dr. Lowsley's paper but am unable to add to the discussion as my experience with local anesthesia in renal surgery has been limited to draining large hyponephrotic kidneys. I was very glad to hear him make a plea for conservative methods in certain kidney lesions. A recent observation is of interest in showing the power of the urinary tract to rejuvenate after back pressure. At the last meeting of this Society I showed a plate of a patient who had a ureteral calculus low in the right ureter with marked dilatation of the ureter and renal pelvis. A pyelogram and ureterogram taken two years after removal of the calculus showed a practically normal ureter and only a very moderate dilatation of the renal pelvis.

DR. E. L. HUNT, Worcester: (Referring to X-ray showing outline of a mass in the kidney region.) I am interested in the suggestion of a dermoid tumor in that peculiar shadow because I have recently had a case in a Syrian woman who had been confined and was supposed to have had recurrent attacks of pyelitis during the pregnancy. After the confinement it was found that she had a large tumor in the right lumbar region. The pyelogram was perfectly normal but the location of the tumor was such that it felt like an enlarged kidney. There was no shadow such as there was in Dr. Lowsley's case or in Dr. Barney's, but I thought I was dealing with a tumor of the kidney, made a kidney incision and found that I had a strangulated dermoid of the right ovary which had become anchored high up during the pregnancy and then as the uterus retracted the pedicle was put on tension cutting off circulation. It was very difficult to get it out through that incision.

DR. W. C. QUINBY, Boston: Except to congratulate Dr. Lowsley on his interesting presentation I have but little to add.

At our clinic we have only used regional anesthesia for operations on the prostate and bladder. There is no reason, however, why it should not be extended to the kidney also. I do, however, agree with Dr. Barney as to the applicability of this type of anesthesia in the difficult adherent kidney. I doubt very much that such a kidney can be satisfactorily operated on by local anesthesia because of the extent of time which would be necessary and the inevitable amount of traction which would doubtless cause struggling on the part of the patient, or possibly shock. I refer to that class of case in which the kidney has been surrounded by perirenal infection and abscess, making it adherent to the muscular bed, and frequently necessitating opening the peritoneal cavity. It does not seem to me that such a condition would be adaptable to such a form of anesthesia, but there is no reason why we should not begin the operation under paravertebral block and later change to an inhalating narcosis.

DR. E. G. CRABTREE, Boston: I am glad to hear Dr. Lowsley's discussion in which he emphasizes that regional anesthesia in kidney surgery has a definite possibility. Whether or not at the end of this period of experimentation we discover that regional anesthesia should not be used in all cases seems beside the point. There come to us all at times certain types of cases in which the avoidance of a general anesthetic is not only desirable, but imperative. If operations of necessity can be done under regional anesthesia in these cases, a gain in surgery has resulted. I have not had a large experience with regional anesthesia. I have done eight cases. Two should be considered complete failures. In the other six, all were comfortable and did not need supplementing with general anesthesia. It must not be forgotten that the position in which kidney surgery is easiest done is not a comfortable position for the patient. He is awake and is compelled to lie in that position during a careful and therefore somewhat protracted surgical operation. I have not attempted to use it in all patients with kidney conditions. I have rather confined my selection to those patients in whom a general anesthetic was contra-indicated and fortunately for me, in whom the type of surgery required was not the most difficult.

I wish to mention in particular one patient who has just left the hospital after a successful operation under regional anesthesia. The patient was an old man who thruout his life carried a fear of surgery. His history indicates five years of very distended bladder with dribbling of urine which had seriously impaired both his kidneys. His illness was due to prostatic obstruction. During the period of preparation for operation phthalein function

tests were entirely unproductive and only the slightest trace of color could be obtained. These tests did not improve on protracted drainage. Eventually under local anesthesia perineal prostatectomy was done with recovery. Patient then returned to his work, gained in weight, and aside from the hypertention with which he entered, and which continued in the neighborhood of 220 after operation, he lived comfortably and did the work he had done for the past 15 years. This operation was done three years ago.

After prostatectomy, the cystoscopic examinations showed no function at all from his left kidney. Function on the right remained low although his non protein nitrogens returned to normal during convalescence. During the past winter he had pneumonia with hematuria on three occasions. These bleedings were painless and ceased in each case after a few days. The third day of his convalescence while sitting in a chair beside his bed he had a severe hemorrhage with clotting of blood in the bladder. There was also clot of the blood in the kidney pelvis on the right which completely obstructed the ureter giving him suppression of 12 hours' duration. At the time I saw him the kidney on the right had increased greatly in size, was very tender, the patient had chills, urinous breath, and was extremely ill. He was immediately moved into the hospital, cystoscoped, and bleeding found to be confined to the right kidney. The other kidney showed no function further than a very small amount of very pale urine which was obtained on inserting the catheter but ceased to drain immediately although boric solution could be injected and returned. Diagnosis of right renal hematuria was made.

Under regional anesthesia a perfectly comfortable operation was performed. The kidney was found very much distended and black from the retained blood clot. By the time operation was done the kidney mass reached almost to the mid line and was very noticeable from the distention of the abdomen which it occasioned. An oblique kidney incision was made which exposed what was supposed to be the pelvis of the kidney. An incision was made through this area which was later demonstrated to be a combined pyelotomy and nephrotomy incision entering the pelvis at the kidney margin. Large quantities of blood clot were cleared away, the pelvis washed clean by irrigation, and tube drainage through the incision was made. The patient made a recovery in three weeks to a condition similar to that preceding his pneumonia. His condition is not satisfactory and probably never will be, yet it is in this type of case that regional anesthesia offers almost perfect substitution for general anesthetics which are not only contraindicated by choice but are absolutely a necessity. If regional anesthesia can be made to fill this need, we can continue to use

general anesthesia on those in whom the risk is no greater than normal.

I doubt if many of us will long continue to do all cases of kidney disease under local anesthesia. There are too many patients on whom local anesthesia is not the procedure of choice in less extensive operations. It is unlikely that kidney surgery will prove an exception to the rule.

DR. W. W. TOWNSEND, Burlington, Vt.: I am glad to hear Dr. Barney ask questions with the spirit of skepticism. I remember a few years ago a gentleman from New York came over and read a paper on the two-stage operation for prostates which was new to us at that time, and he had rather a hard voyage; and if he were alive today, I think he would be very gratified to know that we all appreciate his work and that there is a field of usefulness for the two-stage operation. And I would like to have Dr. Lowsley come back and receive encomium of praise for his pioneer work in regional anesthesia.

DR. OSWALD S. LOWSLEY, New York: I certainly appreciate the gentleness with which I have been handled. I expected a much worse time. We have felt fortunate in having Dr. Anderson with us as he has had an excellent training at the Mayo Clinic. Before he came to us we persisted in our efforts, and I must say that experience is a good teacher in this as well as in any other field. We feel that the last 25 cases were better anesthetized than the first 25! but I don't believe you can tell ahead of time whether you are going to get a perfectly good anesthesia. As one's experience increases, the average number of thorough successes increases.

I was delighted to see Dr. Crosbie's operation this morning. It was very interesting and successful, and his patient went through in an entirely satisfactory manner. He complained only of the slightest bit of pain at one time and waved the ether aside.

Dr. Barney always makes helpful suggestions, and I was pleased to have him ask the questions which he did. I am afraid of spinal. I haven't had enough experience to feel safe with it. I have lost a case, and my confreres have lost others. It seems to me it can't help but be harmful when the patient's blood pressure goes down so low that you can't distinguish the pulse. To all intents and purposes the patient is in deep shock during the operation.

We have had no complaints from any of the patients about position. They complain when one separates the adherent kidney from the peritoneum; and when retraction is made in delivering the kidney.

We try all kidney operations under regional. The echinococcus cyst was bound down to everything. It was a tremendous thing to take out through the loin. The perirenal tissues were filled with dilated blood vessels one of which we

ruptured; one as big as a pencil we tied off, and finally we had to give him a little anesthesia as we delivered the kidney on account of traction on the pedicle. We have never had patients move at all unless they were under ether. So if you have to give them ether except for the few whiffs for the psychological effect it is well to get them entirely under because primary ether anesthesia is dangerous in that they are liable to move.

We have had two pedicles slip in cases that weren't getting ether, and the patient never knew. The case which Dr. Crosbie saw us do was a big tuberculous kidney with a superimposed infection by a non-hemolytic streptococcus. With the big carcinoma of the kidney—he went through that entirely without any anesthesia or any complaint whatever.

I appreciate Dr. O'Neil's remarks. I have become very conservative on kidneys. As my experience increases I become still more conservative. We have a patient, a young lady, who has come back for seven operations. We took the stones out of one kidney, and the other kidney had no function. We cystoscoped her after this operation and learned that about one fifth of the function had returned to the bad side as compared with the good side, so we took the stones out of the kidney, and left the organ in. Formation of stones was stopped by having the urine kept acidified with phosphoric acid. She uses litmus paper, and tests her own urine.

I think as Dr. Quinby does that it is well worth while to start all these cases under regional anesthesia—every one of them, no matter how hard they may be—and then shift and put them under general anesthesia if necessary.

Dr. Crabtree's experience is interesting, and I am much interested in Dr. Gwathmey's suggestion that the routine procedure may ultimately be to give two or three ounces of ether mixed with oil in the colon before giving the injection for regional anesthesia. Gwathmey has shown conclusively that colonic ether doesn't have the damaging effect on the kidney that inhalation ether has. Why, I don't know. But after colonic irrigations with ether and oil phenol-sulphone-phthalein test showed no diminution at all. We are going to try that out on a series of cases soon.

DR. J. G. ANDERSON, New York: I can add very little to what Dr. Lowsley has said. He believes that the administration of local anesthesia is the work of an anesthetist, and not the surgeon. This is of course true regarding general anesthesia, but local anesthesia is fundamentally a surgical procedure, and therefore I disagree with Dr. Lowsley on this point. I took up this work merely as a valuable asset to a surgical armamentarium. I acquired the technic while a Fellow in Surgery at the Mayo Clinic, where local anesthesia is used for all types of surgery, and is not confined to urological cases. How-

ever, urological surgery was done almost entirely under local at the Clinic. Its advantages in these cases are briefly: ability to force fluids by mouth before, during, and after operation; better relaxation of the surgical field; absence of post-operative pulmonary complications; avoidance of loss of blood, inasmuch as no change in blood pressure has been observed under local anesthesia; and the fact that enforced catheterization is practically unknown.

The injection of the quadrilateral space is a procedure very similar to the infiltration of the upper abdomen in intra-abdominal operations, such as gastric cases. Dr. Judd was doing a series of stomach cases in conjunction with ethylene, and novocaine infiltration.

The idea of the elimination of preoperative narcosis came to me while I was working on the neurological service at the Mayo Clinic, as no morphia was allowed to these patients because of the respiratory depression, a system already imposed upon in intracranial lesions. In urological cases, its elimination is just as important, although for different reason, which I have brought out in a paper published in the May issue of *Annals of Surgery*.

The psychic factor is one of the difficult elements in administering local anesthesia. Many patients will complain of pain when it is really a sort of fear and anxiety they are experiencing, and not pain. I do not believe that morphia helps to overcome this psychic factor. Some analgesic is required, after the method of Crile. The low rating of the anesthesia in some of the cases reported tonight should be attributed to this psychic factor, and not to a failure to induce anesthesia.

DR. W. W. TOWNSEND: I would like to ask Dr. Anderson if supplementing the regional anesthesia with ether promotes this primary excitement, what would be the objection to ethylene?

DR. J. G. ANDERSON: None at all. Crile has demonstrated that nitrous oxid analgesia and novocaine anesthesia can be carried out successfully. Also Judd has had a large series of gastric cases in which ethylene analgesia and novocaine anesthesia were combined. If ethylene is used it should be commenced 10 to 15 minutes before the incision is made, rather than during the course of the operation. Vomiting has been noted in a majority of cases following the use of ethylene.

DR. J. D. BARNEY: I move that we give our vote of thanks to Dr. Lowsley for his very illuminating talk and to Dr. Anderson for his contribution.

Motion seconded.

DR. TOWNSEND: I move that it be amended by making it a rising vote.

Motion seconded; carried.

Motion to adjourn made; seconded; carried.



**Case Records  
of the  
Massachusetts General Hospital**

ANTE-MORTEM AND POST-MORTEM RECORDS AS USED IN  
WEEKLY CLINICO-PATHOLOGICAL EXERCISES

EDITED BY

RICHARD C. CABOT, M.D., AND HUGH CABOT, M.D.  
F. M. PAINTER, A.B., ASSISTANT EDITOR

**CASE 11391**

**SURGICAL DEPARTMENT**

A colored laborer of fifty-two entered the hospital for the first time November 20, two years before his final admission. His general health had been excellent. As a young man he had three attacks of quinsy sore throat. At forty he had "bronchial trouble" for a few months with a great deal of cough, especially in the mornings, and much yellowish sputum. He denied syphilis by name and symptoms.

Six weeks before admission, three weeks after exposure to gonorrhea, he began to have a profuse purulent urethral discharge. A physician prescribed injections and gave him capsules. Three weeks before admission he began to have a burning sensation in the perineum and pain on defecation and micturition. The condition had grown steadily worse.

Examination showed in the perineum about two centimeters anterior to the anus and slightly to the left of the median line an exquisitely tender fluctuant mass about the size of an egg. By rectum the prostate was felt to be prominent and tender. There was pain on pressure directed toward the fluctuant area. There was a slight amount of watery urethral discharge. The pupils did not react normally. The knee-jerks were unequal.

The chart was not remarkable. The urine and blood were not recorded before operation. A Wassermann was negative.

November 20 operation was done. The patient was comfortable after it, made an uneventful convalescence and was discharged December 1.

December 13, two years later, the patient returned complaining of sore throat. He now gave a history of diabetes in two sisters. His mother died of gangrene of the leg, possibly diabetic. His father died of dropsy. He himself drank a great deal of water and urinated six or seven times at night.

On Thanksgiving Day he stepped on a spike, driving it well into his foot. The next day a doctor washed and treated the wound with carbolic, later with something he said was used during the war and with hot soaks three times a day. The patient was up and about on

crutches, but bore no weight on the foot. December 8 the foot began to throb and was much more painful.

Examination showed a thin man with extremely bad teeth, pyorrhea, and bean-sized glands in the angle of the jaw on the right. The blood pressure was 200/100. The artery walls were palpable, the temporals and brachials tortuous. No enlargement of the heart is recorded. On the left foot about the level of the transverse arch was a small puncture hole through which a few drops of thin serous pus could be expressed. The foot was slightly tender around this area, but much more tender about two inches posterior to it, where there was a soft and possibly fluctuant area. Lateral and anterior to the puncture wound there was hardly any tenderness.

Before operation the temperature was 99.3° to 97.9°, the pulse 98 to 88, the respiration normal. The urine and blood were not recorded.

December 14 operation was done. The next day the patient felt very well. About an inch back of the anterior end of the wound and on each side was a pus pocket containing considerable pus. Hot boric compresses were used. The urine was found to contain 0.4 to 1.0 per cent. of sugar. A medical consultant reported, "... Low acidotic. Prognosis of foot very poor, although there is a chance to save it. No artery felt today below the knee. Recommend X-ray to determine presence of osteomyelitis and condition of arteries. ..." December 15 insulin was started and diabetic régime instituted. December 16 there was considerable pain in the foot. A Dakin's tube was inserted. That night the temperature rose to 101°. Next day there was a good deal of odor from the foot. On the 18th the skin around the incision looked gangrenous. There was also a fluctuant area on the dorsum. A Wassermann and a blood culture were negative. Smear from the pus from the wound showed a few staphylococci.

December 19 the left leg was amputated. The blood sugar was found to be 161 to 252 mgm\*. Next day the patient felt much better. The chart was satisfactory. December 22 the blood sugar was 204 mgm. The stump was quite painful upon pressure from the end on the 23rd but much less so on the 26th. The diabetic treatment seemed to progress well, though the patient was a worse diabetic than was thought at first, continuing to show .5 to .15 per cent. of sugar in the urine. December 28 there was pus under the middle of the scar. When the skin stitches were removed the wound gaped slightly. The edges were stitched together. Another blood culture was negative. The blood sugar was 226 mgm.

December 30 the patient began to have intense pain in the stump and pain in the left groin. The temperature was 99°, with severe

\*Normally 70-110 mgm., fasting.

lymphangitis. On probing the stump very little pus was obtained. Next day the temperature was 104°, the pulse 150. A medical consultant found the diabetic condition good. January 1 the inguinal glands were not so large or tender as they had been and the stump was less tender. There was slight discharge, though the skin edges were now half an inch apart.

January 2 the left thigh was amputated. Next day the patient looked dry and very ill, although the fluid intake had been ample. The urine showed no sugar or acetone. A blood culture taken the day of the operation showed streptococcus hemolyticus. The patient had hiccups whenever he took anything by mouth. Next morning the respirations were rapid and shallow. That evening he died.

#### DISCUSSION

BY DR. HUGH CABOT

The description of the illness for which he entered two years before his present admission makes it pretty clear that he had an abscess of the prostate which worked its way to the surface through the perineum and required incision. This was probably a complication of his gonococcus infection, though one might doubt somewhat whether it developed within the three weeks after an original gonococcus urethritis. As a rule these abscesses of the prostate develop rather slowly, and commonly later in the disease. It is not improbable that this was either a recrudescence of a previous infection or a fresh infection upon an already damaged mucous membrane. It is of course possible that this was a periurethral abscess not directly connected with the prostate. On the other hand the periurethral suppurations associated with gonococcus infection are commonly in the pendulous portion or at least in front of the bulb.

#### DR. CABOT'S PRE-OPERATIVE DIAGNOSIS

Abscess of prostate.

#### PRE-OPERATIVE DIAGNOSIS, FIRST ENTRY

Periurethral abscess.

#### OPERATION

Gas and ether. A number 26 French sound was passed easily to the bladder. A perineal incision an inch and a half long was made slightly to the left of the median raphe over the area of induration and swelling. An abscess cavity containing about half an ounce of thick yellow pus was opened. The cavity lay close to the urethra, posterior to the bulb and to the left of it. No definite connection with the urethra could be made out. The abscess may well have originated from a periurethral gland. The patient was put upon drainage with purse string and small cigarette wick.

#### FURTHER DISCUSSION

The description of the operation shows as if this were more like a periurethral abscess. On the other hand its situation posterior to the bulb lends color to the view that the infection came from the prostate and perforated in the region of the apex. In any case his convalescence seems to have been satisfactory and the exact origin is relatively unimportant.

At his second entry there is a history of a rather slowly developing infection of the foot. He apparently was fairly comfortable for about a week after the injury and then began to have more active evidence of infection. Examination of the foot at the time of entrance shows clear evidence of an abscess posterior to the wound and apparently at this time fairly well localized. The somewhat brief physical examination shows evidence of hypertension with a pretty wide pulse pressure and evidence of peripheral arteriosclerosis. The family history which he gave on his present admission shows an interesting tendency to diabetes in the family. There is evidence that two sisters and possibly his mother have had the disease. This would of course raise in one's mind the possibility that the sluggish behaviour of this infection was due to the presence of diabetes, since it is notorious that relatively insignificant wounds or infections in the feet of diabetic patients slowly develop to very serious infections. In this connection it is well to remember that the pain associated with these infections in the diabetic is likely to be less than in normal individuals and hence the severity of these infections is sometimes underestimated. It is of course important to be sure before operation whether or not the patient is diabetic, as it will importantly influence both the operation and the general management of the patient. I see no evidence that the condition of the urine was noted and it is possible that in the anxiety to deal with an obvious infection this point was overlooked.

If there was any suspicion of diabetes it would be desirable to avoid ether anesthesia and to use one of the gases, there being but little choice in this particular between nitrous oxid and oxygen, and thylene. I confess I am suspicious of diabetes.

#### DR. CABOT'S PRE-OPERATIVE DIAGNOSIS

Septic foot.  
Diabetes.

#### PRE-OPERATIVE DIAGNOSIS DECEMBER 14, SECOND ENTRY

Septic foot.

#### OPERATION

Under gas and ether an incision was made along the plantar aspect of the foot and the abscess cavity well explored, breaking down all

old adhesions. There was not an exceptional amount of pus, merely old sloughing fascia. The wound was packed wide open with dry gauze.

#### FURTHER DISCUSSION

The condition found at operation lends color to the view that this had been a somewhat sluggishly developing infection. Apparently it was freely incised and left wide open. It would perhaps have been wise to institute treatment by the Carrel-Dakin method at once. From the day following operation there was evidence of spreading infection and some evidence that the gauze had blocked up free drainage. At this time the presence of sugar was definitely determined and treatment with insulin was begun. The severity of his diabetes cannot be properly judged by the condition found at this time, since it is well known that infection will convert a very mild diabetes into a relatively severe one.

As the condition developed during the next five days it was clear that the infection could not be controlled locally and that some further operation done in an area entirely clear of the infection should be undertaken. There is no note to show whether the arteries of the foot were pulsating at the time of the first operation, but immediately afterwards there is a note to the effect that neither artery could be felt. For this reason I doubt whether it would be wise to consider any amputation below the thigh. It is extremely probable that this leg will show extensive arteriosclerosis, a condition which taken with the infection and the diabetes would make the prognosis of any operation below the thigh very doubtful. In any case I believe that at this time the prognosis is poor and that the only possible chance of success is to get entirely clear of the disease and in an area in which the circulation is entirely sound. I should, therefore, advise amputation at the lower third of the thigh.

I believe that the choice of anesthesia should lie between spinal anesthesia and one of the gases. Our experience with spinal anesthesia in these cases has been very satisfactory, and I should be inclined to select it.

#### DR. CABOT'S PRE-OPERATIVE DIAGNOSIS

Septic foot.  
Arteriosclerosis.  
Diabetes.

#### PRE-OPERATIVE DIAGNOSIS DECEMBER 19, SECOND ENTRY

Diabetes mellitus and septic foot.

#### OPERATION

Under spinal novol the left lower leg was amputated at about the junction of the lower and middle thirds.

#### FURTHER DISCUSSION

Apparently they thought it safe to amputate through the lower leg. The description of the operation does not show whether the circulation at this level was in thoroughly first-class condition, but in any case it was undoubtedly a somewhat risky performance.

It is interesting to note that there was an apparent increase in the severity of his diabetes. This is only what is to be expected in the presence of infection and does not throw much light upon the real severity of the disease. It was not apparently possible entirely to control the output of sugar by the use of insulin.

For a time the amputation wound did well, but gradually very definite infection developed and spread up the leg. By the eleventh day after operation there was evidence of severe spreading infection with severe constitutional reaction and high temperature. By the second of January the evidence was of a widespread infection strongly suggesting a septicemia, and in fact a blood culture showed a streptococcus in the blood.

I doubt whether any further operation at this time had any hope of success and I think I should have hesitated to undertake it.

Neeropsy should show evidences of a streptococcus septicemia with probable enlargement and softening of the spleen. It should also show marked arteriosclerosis and changes in the pancreas associated with diabetes.

#### DR. CABOT'S PRE-OPERATIVE DIAGNOSIS

Streptococcus septicemia.  
Diabetes.

#### PRE-OPERATIVE DIAGNOSIS JANUARY 2, SECOND ENTRY

Septic stump or streptococcus septicemia.  
Diabetes mellitus.

#### OPERATION

Under spinal anesthesia thigh amputation was done in the lower third. The wound was closed without drainage. The operation was completed with all haste in twenty-six minutes.

#### CLINICAL DIAGNOSIS (FROM HOSPITAL RECORD)

Diabetes mellitus.  
Streptococcus septicemia.  
Incision and drainage of septic foot.  
Amputation below knee.  
Reamputation above knee.

#### DR. HUGH CABOT'S DIAGNOSIS

Streptococcus septicemia.  
Soft spleen.  
Arteriosclerosis.  
Disease of pancreas.

## ANATOMICAL DIAGNOSIS

1. *Primary fatal lesion*

(Diabetes mellitus. Diabetic gangrene of left foot with three operations for amputation. Streptococcus septicemia.)

2. *Secondary or terminal lesions*

Arteriosclerosis.  
Hypertrophy and dilatation of the heart.  
Soft hyperplastic spleen.  
Hemorrhagic edema of the lungs.

3. *Historical landmarks*

Operation wound.  
Slight chronic pleuritis, right.

DR. RICHARDSON: The age was given as fifty-five years. Anatomically the man looked considerably older.

The head was not examined.

The gastro-intestinal tract was negative except for a few scattered areas of ecchymosis in the mucosa of the stomach.

The pleural cavities were empty and there were only a few slight adhesions in the region of the right apex. The trachea and bronchi contained much thin reddish frothy fluid.

The lung tissue generally was spongy, pale red to dark red and yielded a large amount of coppery red frothy fluid.

The heart weighed 405 grams, slightly enlarged. The myocardium, valves, cavities and coronaries were negative. The aorta above the diaphragm showed a slight amount of fibrous sclerosis with a few areas of fibrocalcereous change. In the abdominal portion there was much fibrous sclerosis with intermingling calcareous areas. The iliac arteries showed a slight amount of fibrous sclerosis. All told considerable sclerosis for fifty-five years of age.

The spleen was slightly enlarged and there was a band of old adhesions extending to the diaphragm. The tissue was mushy.

Culture from the heart blood showed streptococci and bacilli.

A case then of diabetes associated with arteriosclerosis and slight hypertrophy and dilatation of the heart with streptococcus infection, a soft hyperplastic spleen and hemorrhagic edema of the lungs.

## FURTHER DISCUSSION BY DR. CABOT

The necropsy developed nothing unexpected.

The interesting side of this case is the true-ness with which it ran to form in the relation between infection of the lower extremity and diabetes. Failure to recognize the presence of diabetes in these infections is a tremendous handicap to treatment. It is strikingly true that infection of this type almost always develops in an uncontrolled diabetic and is rarely

seen in patients with this disease who are under treatment and carefully following their directions. The surgeon is very likely to find himself always about one jump behind the infection, and it is of the first importance to deal with these conditions sufficiently radically on the first occasion.

The question whether the process should be treated by local incision and drainage or by amputation will turn upon the condition of the arteries of the leg. If the circulation of the foot is compromised by arteriosclerosis and the tissues are also handicapped by a pre-existing diabetes, the prognosis for a local operation is likely to be bad. Under these conditions the only hope of saving life often consists in what appears to be an unduly radical operation above the bifurcation of the popliteal artery. If the circulation of the leg is thoroughly good and there is no evidence of arteriosclerosis, local operations are likely to be a success, though the wounds are always sluggish and convalescence often very tedious. Since the introduction of insulin the probability of satisfactorily controlling the sugar while maintaining the patient on a satisfactory diet has added very much to the proportion of favorable results.

## CASE 11392

## MEDICAL DEPARTMENT

A MARRIED American woman forty years old entered through the Emergency Ward May 9 complaining of dyspnea, vomiting and precordial pain. She was very nervous, vomited several times in the Emergency Ward, and belched considerable gas. The heart rate was rapid, the pulse of good quality. She was given half a grain of codeia when she vomited and one-eighth of a grain of morphia.

She gave a history of one child stillborn at five months fifteen years before admission, following the birth of two healthy children. Three years before admission she noticed shortness of breath on exertion. This gradually increased. At times she was troubled with gas. A year before admission she had precordial pain on exertion and pain in the left arm, more or less localized between the elbow and the wrist. She had had dyspnea, but this had not been such a menacing symptom as the pain, vomiting and gas.

Examination showed a well nourished woman, slightly cyanotic and dyspneic. The eyes were prominent. There was bifid uvula. The apex impulse of the heart was felt in the fifth space 9 cm. to the left of midsternum. The action was regular, with an occasional dropped beat. The pulmonic second sound was not accentuated. The aortic second sound was absent or very feeble. There was possible transmission of the pulmonic second. There was a systolic murmur at the apex and base transmitted to the neck, a



systolic thrill in the supraclavicular space. There was a diastolic murmur along the left sternal border, and a diastolic at the apex, possibly of aortic origin. The supracardiac dullness was increased to the right. The percussion measurements were: left border 9 cm. from midsternum,  $1\frac{1}{2}$  cm. outside the midclavicular line, right border 3 cm. from midsternum, supracardiac dullness 7 cm. The blood pressure was 150/60. The rest of the examination was negative.

Fifteen minutes after her admission to the Emergency Ward the patient vomited again and suddenly died.

#### DISCUSSION

BY DR. MAURICE FREMONT-SMITH

The patient was evidently a very sick woman when admitted to the Emergency Ward. The picture is that of a cardiac patient showing marked decompensation. Such a patient needs morphia and needs it badly. A quarter of a grain subcutaneously at once would have been, in my mind, the right thing to give, unless this woman was a very light individual. Digitalis, of course, is indicated and in such a case had probably better be given intramuscularly in large doses. The first move, however, should be morphia.

Pain in the left arm and chest coming on after exertion is pathognomonic of angina pectoris. For some reason—unexplained, except that one may attribute it to the greater sensitiveness to pain on the part of a woman—women patients frequently present pain in the chest, radiating down the arm, which is of the angina type and yet does not carry with it the grave prognosis of true angina. Women may have precordial pain radiating down the arm on exertion for years without any typical severe attacks of angina. Of course the pain in the true angina is substernal rather than precordial. There is a sense of compression, bringing with it the fear of death, causing absolute cessation of motion on the part of the patient. It is often accompanied by a cold clammy skin, a slow pulse and a heightened blood pressure. It is relieved by the nitrites, and with or without treatment persists a few seconds to a few minutes only. If the pain of angina persists longer than this brief period, or is unrelieved by nitroglycerin, one has to consider most seriously the probability of coronary thrombosis. In this latter condition the blood pressure falls while the pain persists. A friction rub is frequently, although not always, audible over the precordia, and the patient goes into severe shock. Recovery is not the rule, but temporary recovery may occur, patients usually having another attack leading to death in a few months.

As to the physical examination: The heart here is somewhat enlarged, but not downward and to the left as much as one would expect in a case showing, as this does, the evidence of

aortic stenosis and regurgitation. It is interesting that there was difficulty in deciding whether the diastolic murmur at the apex was caused by the aortic refluxes or by a mitral stenosis. The two murmurs are quite different in type and in timing, and it is usually possible to distinguish them. The aortic murmur, even when heard at the apex, keeps its characteristic early position in diastole and its high-pitched blowing quality. The murmur of mitral stenosis, on the other hand, begins in middiastole and may or may not fill the latter half of diastole. It is low-pitched, often rumbling, and frequently crescendo in type.

We have no history to help us decide between the two types of cardiac disease, into one or the other of which this case must fall. The increased supracardiac dullness, the presence of a marked aortic lesion without much evidence of a mitral, the rather rapid onset of failure in a woman over thirty-five, all point to syphilis as the cause of the cardiac condition. On the may pick out the aortic valve alone far more likely to have Corrigan pulse and the very low diastolic pressure than is the rheumatic type. We know, moreover, that the rheumatic infection may pick out the aortic valve alone for more frequently than was formerly thought.

What was the cause of the sudden death, coronary thrombosis or rupture of the ventricle? Or shall we find neither of these two, but simple hardened narrowed coronary vessels? I believe we shall find evidence of coronary thrombosis on the basis of the persistent pain and the evidences of marked prostration. Whether or not the thrombosis will have progressed far enough to give infarction and rupture of the wall it is impossible to say.

#### CLINICAL DIAGNOSIS (FROM HOSPITAL RECORD)

Mitral and aortic regurgitation.  
Cardiac hypertrophy.  
Angina pectoris.

#### DR. MAURICE FREMONT-SMITH'S DIAGNOSIS

Syphilitic heart disease. Aortitis.  
Aortic regurgitation and stenosis.  
Coronary thrombosis.

#### ANATOMICAL DIAGNOSIS

##### 1. Primary fatal lesion

Luetic aortitis involving several portions of the aorta and the aortic valve and the coronary orifices with marked diminution of the latter.

##### 2. Secondary or terminal lesions

Hypertrophy and dilatation of the heart.  
Chronic passive congestion.  
Fatty metamorphosis of the liver.  
Soft hyperplastic spleen.

3. *Historical landmarks*

Slight chronic pleuritis, left.  
Fibromyoma of the uterus.

DR. RICHARDSON: The head was not examined. On the left there were a few pleural adhesions at the apex and a few to the diaphragm and the pericardium. The lungs showed a moderate amount of chronic passive congestion.

The heart weighed 485 grams, considerably enlarged. The myocardium was negative macroscopically and microscopically. The valves were negative except that the aortic showed fibrous thickening and deformity of the cusps with narrowing of their widths, all of which was associated with a process in the aorta to be described. The process in the aorta extended about the coronary orifices with marked reduction of them. The orifices were about 1 mm. in diameter. The coronaries beyond the orifices were negative. The ascending thoracic portion of the aorta showed marked scar-like fibrosis which extended up along the intima and downward about the orifices of the coronary arteries and involved the aortic valve. The wall of the aorta was generally thickened, about 4 mm. On cross section the intima and media showed fibrous thickening and fusion, with thickening and reddening of the adventitia. The thickened media was a little soft in places. The process in this portion of the aorta continued along the arch, the descending thoracic, and well into the abdominal portion. In these regions the wall was not quite so thick and the process not so well marked, but the condition in each portion was practically the same, —syphilitic aortitis.

The liver showed passive congestion and some fatty metamorphosis.

The spleen was slightly enlarged and mushy.

The uterus was slightly enlarged. In the wall of the fundus there was a frank fibromyoma 3½ cm. in diameter. The cavity contained a small amount of blood and mucus. The tubes and ovaries were negative. In the right ovary there was a corpus hemorrhagicum.

A case then of luteic aortitis involving several portions of the aorta and the aortic valve with practical occlusion of the coronary orifices.

## CASE 11393

## SURGICAL DEPARTMENT

An Irish laborer of twenty-one entered May 12 complaining of pain in the left upper quadrant of six months' duration and frequent urination. His father, one brother and he thought two sisters died of tuberculosis. Another sister died of brain tumor. He had measles and possible influenza in childhood. He had moderate dyspnea and slight palpitation on exertion. For three years he had had cough with some sputum.

Nine months before admission he first noticed urination at night with increased frequency during the day and cloudy urine. Three months later he had pain in the upper abdomen, more marked in the left upper quadrant, steadily increasing in constancy and severity. He also had pain in the left upper quadrant and suprapubically when urinating. The frequency and pain increased up to four months before admission. At that time the urine was bloody, with the passage of blood clots during twelve hours. He had had no hematuria since that time except for a very slight red stain at times after straining hard to urinate. The other symptoms had continued. He had pain in the middle left quadrant ceasing for about fifteen minutes after micturition but gradually returning. At admission the urine was still cloudy and contained much sediment. For two months he had not been able to work on account of pain.

Examination showed a fairly well nourished, muscular young man with pale seborrheic skin showing an acneiform eruption over the chest. Many small glands were palpable along the sides of the sternomastoid. The axillary, epitrochlear and inguinal glands were palpable. Deep pulsation was visible at the base of the neck, and slightly dilated veins which did not fill from below. The chest expansion was fair, with slight diminution over the right back. The lungs were negative except for the left apex, where there was relative dullness anterior to the supraclavicular fossa and posterior to the top of the scapula. Over this area the breath sounds were diminished in intensity but unchanged in quality. There was marked diminution in vocal and tactile fremitus. No râles were heard. The apex impulse of the heart was in the fifth space, nipple line, the left border of dullness 1 cm. to the left of the nipple line. The right border was at the right sternal margin. The action was slow and regular. The sounds were of fair muscular quality. The first sound approached the second sound in quality. There were no murmurs. The abdomen showed no abnormal masses or areas of rigidity. There was slight tenderness in the left middle quadrant; no costovertebral tenderness. The kidneys were not palpable. Rectal examination showed the prostate rather firm, smooth, not enlarged or tender except for a hard nodule in the right lobe near its lower pole.

Before operation the temperature was 97° to 98°, the pulse 60 to 88, the respiration normal. The urine was cloudy, with a large trace of albumin, specific gravity 1.011. The sediment showed rare red blood cells and was filled with pus cells. X-ray March 23 showed a faint shadow in the region of the pelvis of the left kidney, probably not a stone. March 21 a urine culture was sterile. March 26 cystoscopy

was done with a number 26 French catheter cystoscope. The bladder was not intolerant, washed clean, and held five ounces easily. The base was not acutely inflamed, but was much distorted. Several pits were seen in the region of the left ureter, none of which took the catheter. Near the region where the right ureter should be there was a mound with an orifice on the outer side. Into this the catheter passed and drained clear sparkling urine which ceased to run, so that a function was not done. X-ray was taken to prove which side was catheterized. Guinea pigs were inoculated with urine from the right ureter and the bladder. Five weeks later both guinea pigs showed tuberculous lesions of the glands, liver and spleen. Culture of urine from the right kidney showed no growth. The sputum was negative for tubercle bacilli. X-ray April 21 showed large calcified glands at both lung roots and calcified spots well out in the lung substance. The lung markings were prominent. The plate was interpreted as showing tuberculous glands but no positive evidence of phthisis. The renal function April 27 was 35 per cent., May 12, 15 per cent. May 7 a cystoscopy was attempted, but the stricture was too tight. May 14 cystoscopy showed the bladder distorted as before. The left ureter was not seen. The right ureter was easily identified. The catheter easily passed to the kidney. 1 c.c. of renal function solution was injected intravenously. A catheter was inserted also to the bladder. The appearance time for the right kidney was four minutes, the total for fifteen minutes 18 per cent. The appearance time of the bladder urine was five minutes, total for fifteen minutes 7 per cent. The right kidney urine sediment showed no pus. Culture showed no growth.

May 15 operation was done. The patient made a good operative recovery. Except for some gas pain the following day and occasional pain in the wound he made good improvement until May 27. During the next nine days there was considerable elevation of temperature. Five pus pockets in the wound were found and wicked. After this he gained strength rapidly, and at his discharge June 9 felt very well. There was very slight discharge from the wound, which was granulating well.

January 27, seven months later, the patient reentered the hospital. Three months before admission he had a little hematuria at the end of urination. Six weeks before admission he noticed slight pain in the testicle and the bladder. The testicle was slightly tender and felt heavy. This gradually grew worse. At the Out-Patient Department sounds were passed. At admission micturition was difficult to start and stopped suddenly, at times beginning again with much difficulty. He urinated five or six

times by day, ten or twelve at night. There was constant pain in the bladder and pain in the urethra during and after urination. The urine was very pale.

Examination was as before except for the operation wound and a tumor which seemed to spring from clavicle, hard, immovable and not tender. Rectal examination showed both vesicles enlarged, hard, not tender. The prostate was generally enlarged, the right side larger and harder than the left. The left epididymis was hard and nodular and the urethra showed a stricture tight to Number 15.

January 28 operation was done. There was moderate bleeding next day, and so much discomfort from the catheter that it had to be taken out January 31. After this he was comfortable and February 3 was discharged relieved.

February 6, three days later, he was sent in from the convalescent home with a temperature of 102° and pain and tenderness in the right kidney region. He was put upon constant drainage and quieted down temporarily. There was however severe irritation from the catheter, which was removed with great relief. February 10 it was again put in, but was left a very short time because of marked pain. February 11 he was again sent to the convalescent home.

February 26 he was sent back from the convalescent home to the hospital because of elevated chart and pain in the left kidney region. He was kept in bed and given forced fluids and soft solids. The temperature and pulse fell rapidly and by March 3 were normal. March 4 he was discharged to the Out-Patient Department, to be sent to a sanatorium from his home.

Records of the Social Service Department show that he was admitted to a tuberculosis sanatorium May 17. The Sanatorium reported that he was found to be an advanced case, with involvement of one lobe on each side complicated with tuberculous kidney and orchitis. During a stay of one hundred twenty-five days he gained fourteen pounds. He was discharged against advice with a negative sputum and a favorable prognosis.

November 19, six months later, he was working under the supervision of the Anti-Tuberculosis Society.

The Out-Patient Urological Department records show that he made numerous visits to that department, where the stricture was dilated. The urine was always hazy. The following March bougie Number 17 was passed. In May and August of the same year he reported at the Tuberculosis Clinic looking very well and working steadily as a team driver. Sound Number 14 was passed in August with considerable difficulty.

## DISCUSSION

BY DR. EDWARD L. YOUNG, JR.

With as marked a family history of tuberculosis as this patient shows the question comes up about the sister who is said to have died of brain tumor, as that may well have been another manifestation of tuberculosis either in the form of a solitary tubercle or tuberculous meningitis.

The story as he gives it, aside from any physical examination of course, prejudices us very strongly in favor of his having miliary tuberculosis. Marked frequency with hematuria is entirely consistent and I believe most commonly seen in urinary tuberculosis when it is in a person of this age. The examination bears out our belief, because the urine, which contains a great deal of pus and shows no organisms on culture, should be considered tuberculous until proved otherwise.

The cytology is in favor of left renal tuberculosis except that a tuberculous bladder is generally not so tolerant as this apparently was.

Whenever an X-ray of a kidney shows faint shadows in the kidney shadow which may well be tuberculous it is always suspicious of a partial calcification of a tuberculous abscess and always suggests a fairly advanced lesion.

The work that was done on the separate kidney examination is a little disappointing in our desire for a clean bill of health for the right kidney, because although the urine was free of pus it did show a positive guinea pig test. Nevertheless the actual damage is in the left kidney, as shown by the split function, and it must be remembered that a normal kidney can excrete living tubercle bacilli, so that in the absence of pus from a kidney the diagnosis of renal tuberculosis can not be positively made. In this case it was felt that the evidence justified the conclusion that the damage to the right kidney was nil, and even the evidence of infection was not conclusive, so that the removal of what was apparently a badly damaged left kidney was justified. Operation was done on that basis.

## DR. YOUNG'S PRE-OPERATIVE DIAGNOSIS, FIRST ENTRY

Left renal tuberculosis.

## OPERATION

Gas-oxygen with a small amount of ether. Eight-inch oblique left lumbar incision. The kidney was freed with slight difficulty. The ureter was found much enlarged and thickened. It was freed to the brim of the pelvis, clamped, cut, carbolized down to the bladder, and then tied. The pedicle, which was very short, was clamped and cut. The vessels were tied individually. Then a mass suture was placed around the pedicle. There was a slight leak

from the pedicle, which had to be tied a second time. The wound was closed in layers with a catheter in place. 150 c.c. of salt solution was introduced into the cavity through the catheter, the latter removed and the skin approximated with silkworm gut sutures.

The kidney was split. The upper pole was found to contain a cheesy focus about half a square inch in size with miliary tubercles in the cortex about this focus.

## PATHOLOGICAL REPORT

Microscopical examination of the kidney shows on the free surface cheesy tissue surrounding which are areas with small round epithelioid cells, scattered giant cells, and cheesy degeneration. Section of the ureter shows the membrane mostly destroyed. In one place a small nodule of round and epithelioid cells with cheesy degeneration.

## Tuberculosis.

## FURTHER DISCUSSION

The pathological report bears out the diagnosis, and the patient behaved after operation as a great many of these tuberculous cases do, namely, the wound broke down to a certain extent and healed somewhat slowly. The removal of a tuberculous kidney removes only part of the disease, and although this may be the main part, still the bladder may make trouble for some time. Apparently this happened here.

The diagnosis here is tuberculous epididymitis and stricture. The treatment for a tuberculous epididymitis varies depending on the surgeon consulted. It goes all the way from no interference at all other than a general tuberculosis régime to a radical removal of the whole genital tract including the seminal vesicles.

## DR. YOUNG'S PRE-OPERATIVE DIAGNOSIS, SECOND ENTRY

Tuberculous epididymitis and stricture.

## OPERATION

Spinal anesthesia. Incision in the scrotum. The epididymis was separated from the testicle and the vas from the cord. This was clamped, divided, pushed into the inguinal canal and cut. Macroscopically the vas showed no involvement. A resilient stricture extending from the bulb to the penoscrotal angle was cut with Otis to Number 30. The wounds were closed.

## PATHOLOGICAL REPORT

A thickened porky piece of tissue with yellowish foci on section. Microscopic examination showed fibrous tissue with numerous areas of round and epithelioid cells and scattered giant cells and extensive tissue degeneration.

## Tuberculosis.



#### FURTHER DISCUSSION

The best treatment seems to be between the two, namely, the removal of the most active focus in the epididymis and vas. In this case that was done, and in addition the stricture was divided. The patient again recovered with a stormy convalescence and gradually improved. The signs which he showed in the lungs apparently increased, and he was sent to a sanatorium for treatment of the lung infection. He made good improvement and was able to go to work.

After his discharge the urinary condition gradually quieted down, and although he never lost the infection he was able to go about and feel well.

The last entry mentioned is the story of an acute appendicitis, and his response to operation shows that he was well past the acute stage of tuberculous infection.

#### LATER HISTORY

August 1, a year later, and two years and five months after his fourth discharge from the hospital, he entered the wards for the fifth time, giving a negative history of the interval except that he had lost a little weight and had felt a little ill during the past few months. He had had no urinary symptoms of any sort.

The night before admission he had onset of general abdominal pain accompanied by nausea. The pain settled in the right lower quadrant and grew worse. Upon examination he was in great distress. The lungs were clear and resonant except for abnormal dullness at the apices. The abdomen was held rather tense but not rigid. There was slight suprapubic tenderness and marked tenderness in the right lower quadrant. No masses were made out.

Operation was done the day of admission, and a thickened and indurated appendix removed. A pathological report of acute appendicitis was made. The patient made a good ether recovery and an uneventful convalescence and was discharged relieved August 11.

#### FURTHER DISCUSSION

This last note was in 1917. Word from the patient since that time shows that he had been able to get into the navy during the war and be on active duty in the North Sea through the hardest part of the campaign. Inasmuch as his urine has always been loaded with pus, cross questioning brought out the admission that he went up for examination with a friend who went prepared to supply the urine for both, which was successfully done. He is now hard at work, in perfect condition, supporting the last of his family, who is dying with tuberculosis. So far as any examination of the urine is concerned the infection there now is a mixed

infection, not tuberculous, and a general examination fails to show any evidence of active tuberculosis anywhere. This story is a good example of the value of fighting out to the last ditch in these cases of tuberculosis, because the point where the resistance of the body can "carry on" may be reached at any time.

#### DIAGNOSIS

Urogenital tuberculosis.

#### A SO-CALLED CONSUMPTION CURE

The most recent drug to be proposed for the treatment of tuberculosis is a preparation called Sanocrysin. This drug is a combination of gold and sulphur salts and for that reason is sometimes spoken of as the "gold cure" for tuberculosis. It appears that experiments have shown this preparation to be an extremely dangerous drug to animals that have tuberculosis. Reports with reference to its use on human patients are not convincing. In fact, a considerable number of such patients died. Thus the verdict must be that the claims for the "gold cure" are not proven.—*Connecticut Health Bulletin*.

#### ERGOT FOR HYPODERMIC USE

SOME of our most valuable drugs are dependent entirely upon the pharmaceutical manufacturer for their reliability. Take ergot as an example. It is not to be expected that all natural specimens will contain the same percentage of active principle, and experience has proved that they do not. The necessity of standardizing ergot preparations has long been apparent, but chemical methods were not available because of the complexity of the active principles. Once it was thought that ergotinic acid was the active principle, but now the less of this an ergot preparation contains the higher it is rated, other things being equal. The alkaloid ergotoxin is very important, but certain amounts of the amines, histamine and tyramine, must also be present.

Since, however, ergot has long been used in medicine for its effect upon the involuntary muscles, the idea occurred to Dr. Houghton, of Detroit, in 1895, that an ergot preparation might be tested by administering it to cocks and observing its effect upon the comb, the degree of bluing or blackening produced being taken as an indication of the physiologic action of the specimen.

It is sometimes desirable to administer ergot hypodermically, but the ordinary fluid extracts are not suitable for this purpose. To give a small dose double efficiency.

Manufacturers of pharmaceuticals have supplied preparations which meet the indications.

## THE BOSTON Medical and Surgical Journal

Established in 1828.

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### CARREL'S CONCEPTION OF CANCER

In contradistinction to the current publicity and comment on the cancer research of Gye practically no notice has been taken of work along similar lines by Carrel at the Rockefeller Institute. Numerous articles<sup>1</sup> have been recently published by this investigator and the work seems so promising that its importance should be emphasized.

Employing the technique and knowledge acquired during the last fourteen years in the study of tissue cultures Carrel found that when one adds a cell free filtrate from a Rous' chicken sarcoma to a pure tissue culture of monocytes from the blood the cells of this culture undergo certain retrograde changes, the surrounding coagulated plasma becomes liquified and the cells or liquid of the culture acquire the property of producing sarcomas on injection into chickens. The same morphological changes were noticed in the migrating amoeboid cells in cultures of other sarcomas and teratomas and similarly there was liquefaction of plasma. On the addition of cell free filtrates from "tar" chicken sarcomas, which will be described later, to cultures of blood

monocytes not only were these cultural changes noticed but in one instance in which the sarcoma was very malignant the cells and fluid of the culture became capable of causing malignancy on injection.

It is well known that if bits of fresh embryonic tissue are grafted or fresh embryonic pulp is injected subcutaneously in a chicken a non-infiltrating, non-malignant teratoma results. Bits of such a tumor transferred to another chicken give negative results. Carrel found that if small amounts of tar are injected intravenously into a chicken with such a tumor in some instances the tumor increases greatly in size, becomes infiltrating and on transfer is capable of causing tumors in other chickens. Such a tumor is called tar chicken sarcoma and is of the type mentioned in the preceding paragraph.

On the basis of the above and other findings Carrel has concluded that two factors are necessary for the production of malignant tumors—(1) a focus of active cell multiplication and (2) a non-specific chemical substance such as tar, arsenic, certain substances produced by bacteria or tissues injured by X-rays, etc. When one of the latter, or a substance resulting from its action on the body tissues, finds itself in contact with body cells in process of active proliferation, the cells become "sick" and manufacture a substance similar to the filterable agent of Rous' chicken sarcoma. He states it is possible that toxic substances in normal serum may act on the cells of an area of chronic inflammation in the same way that tar injected into the blood stream acts on a benign chicken teratoma.

The majority of pathologists have maintained that cell reproduction either in normal body growth and maintenance or following injury is ordinarily held in check by some unknown means. When this control is lacking, malignancy is very apt to result. Carrel's hypothesis fits in nicely with this conception, much more so, in fact, than the theory recently advanced by Gye. It is easier to conceive of a tumor as arising from the action of a non-specific chemical substance on an area of active cell proliferation rather than from the combined action of a specific chemical substance and a non-specific living virus.

### THE BERKSHIRE MEDICAL JOURNAL

We are obliged for a copy of this publication and for the very kind remarks in the article relating to the Massachusetts Medical Society in which cordial sentiments for this journal are recorded. We note with interest that the *Berkshire Medical Journal* claims the largest circulation in New England. The *Journal of the American Medical Association* and the *Boston Medical and Surgical Journal* will have to make

<sup>1</sup> Carrel, A., J. A. M. A., 1925, LXXXIV, 157 and 1795, *Compt. rend. de la Soc. de Biol.*, 1925, XCII, 584, 1491 and 1493, and 1925, XCIII, 10, 12 and 35.

great efforts to avoid being eclipsed. We have only one criticism which is that the modesty of the Editor of the *Berkshire Medical Journal* evidently compels him to keep his name from the public. We can assure our readers that the *Berkshire Journal* is worth reading. We will bow gracefully to the inevitable in its claim of supremacy.

#### THIS WEEK'S ISSUE

Contains papers by the following named authors:

BENEDICT, FRANCIS G., A.B., Harvard; Ph.D., University of Heidelberg; Sc.D., Wesleyan University; Fellow American Academy of Arts and Sciences and member of several other scientific bodies. His subject is "The Control of Gaseous Metabolism Apparatus."

BOYD, DOUGLAS, M.D., Harvard; Former Surgical House-Officer, Peter Bent Brigham Hospital; Assistant in Medicine, Rockefeller Institute, N. Y., 1924-1925. Now Assistant Resident Surgeon, Lakeside Hospital, Cleveland, Ohio. The paper is from the Surgical Clinic, Peter Bent Brigham Hospital, Boston; the title being "Echinococcus Cyst of the Spleen."

LOWESLEY, OSWALD SWINNEY, M.D., Johns Hopkins; F. A. C. S.; Consulting Urologist at the Hospital for Ruptured and Crippled and several other Hospitals; Director of the James Buchanan Brady Foundation. The title of his paper is "Operations Upon the Kidney Under Paravertebral Anesthesia," which appears in the Transactions of the N. E. Branch American Urological Association.

#### MISCELLANY

##### SOME OF OUR PROBLEMS AS SEEN BY A CALIFORNIA EDITOR

One of the scientists who went to Tennessee and was barred from testifying for Scopes came from an Eastern State that has no medical college. Why? Because there is a law in his State prohibiting the dissection of any human body, and no student can be adequately trained in medicine without actually working on and studying the body. When this law was proposed the scientists were indifferent and said it had no significance. What would happen if all the other States passed the same law? The doctors of the future would be as untrained and incompetent as cultists.

If the anti-vivisectionists and cultists had their way in California we today would have none of the life-saving serums and vaccines which have halted the march of former fatal diseases. Animal experimentation is not only the friend of man, but of all animals and has found the remedy for many maladies and literally saved millions of animals from suffering and death. All this would be prohibited if

the anti-vivisectionists, who have never contributed in any way to the alleviation of human suffering, had not been opposed and defeated at the polls and in the Legislature.

Misguided organizations are ever active in California trying to substitute silly sentiment for beneficent scientific methods. They would obstruct the preventive and curative work of physicians for patients suffering from tuberculosis, syphilis, infantile paralysis, and many other diseases, and close the doors of laboratories that are working unselfishly to advance the welfare of men and animals.

Scientists would be barred from their own laboratories if effective organizations like the League for the Conservation of Public Health were not always vigilant. Scientists from time to time deery and belittle politics as something beneath the notice of the erudite. Such men, by their indifference and inactivity place the right of self-government out of their hands. Scientists as well as all other citizens have civic obligations in our representative democracy. Ours is a government in city, county, State and Nation of, by and for the people. If in its operation the actual government runs counter to the theories of scientists, and they are occasionally barred, one of the reasons may be found in the failure of a large number of scientists and other intelligent citizens to inform themselves and vote intelligently and regularly. There are some who are always clamoring for government by some Solomon, but they forget to go to the polls to select this superman. What has been done in Tennessee will probably be attempted in California. It is regrettable that the arrogant assumptions, irreligious assertions and violent hypotheses of agnostics and atheists, which have no proper place in the discussion or teaching of evolution, have a tendency to alienate the support of many who, while believing devoutly in revealed religion, are also loyal supporters of the utmost freedom in scientific research. When the battle reaches our Legislature it will be decided not by resolutions or this summer's whirlwind, but by votes of members who will be elected next year. The primary election which will be held in August, 1926, will have more determining influence on the outcome than any partisan statements made during the present confusing controversy.—*Better Health, San Francisco.*

#### The Massachusetts Medical Society

##### MEMBERSHIP CHANGES

- Dr. Carl A. Dahlen has moved from 819 to 817 Beacon Street, Boston.  
Dr. G. Philip Grabfield has moved from Boston (Suffolk) to Milton (Norfolk). His office is at 23 Bay State Road, Boston.  
Dr. Charles H. Keene has moved from Harrisburg, Pa., to Buffalo, N. Y., where he is at the University of Buffalo.

Dr. Clarence M. Kelley has moved from Taunton (Bristol North) to Worcester (Worcester), where he has an office at 37 Brownell Street.

Dr. Abraham F. Thomas has moved from Newburyport, Mass., (Essex North) to Titusville, Fla., General Delivery (Non-Resident List).

Dr. W. Stewart Whittemore has moved his office from Brattle Street to 3 Concord Avenue, Cambridge, Suite 1.

Dr. Cordelia I. Williamson has moved from London, England, to Murfreesboro, North Carolina, where she is at Chowan College.

# REPORT OF THE DELEGATES FROM THE MASSACHUSETTS MEDICAL SOCIETY TO THE ANNUAL MEETING OF THE MAINE MEDICAL ASSOCIATION

Dr. Walter L. Burrage,  
Secretary Massachusetts Medical Society.

Dear Doctor:

The undersigned delegates from the Massachusetts Medical Society attended the meeting of the Maine Medical Association at Bar Harbor, June 24 and 25, 1925, and both were called on at the opening session to extend greetings from our Society. The registration at the meeting was 130, considerably less than is usual, partly because Bar Harbor is not as easily reached as some of the larger cities, and partly because a large fraternal organization was holding its convention elsewhere in the State at the same time, thereby drawing away some attendance. The scientific program of the meeting was an attractive one, with papers by both residents and non-residents of the State, but was marred by a serious accident which occurred to the president of the society, Dr. F. W. Mann of Houlton, while he was on his way to Bar Harbor. The banquet on the evening of the 24th was a particularly pleasing event, with two addresses, one by Dr. Fishbein of Chicago, editor of the *Journal of the American Medical Association*, and the other by Dr. McCormack of Louisville, secretary of the Kentucky State Board of Health, also representing the American College of Surgeons. The former reviewed the activities of the home office of the national society, and the latter, State and national public health activities. Both were worth going a long way to hear. The Maine Association makes a policy of having some official from the American Medical Association present at every annual meeting, and has found it very profitable to do so. The American Medical Association office is very glad to accede to requests for such representatives; the suggestion is one that might well be adopted by other States, Massachusetts included. The hospitality which the Maine Association and the local Bar Harbor physicians extended to your delegates will not be forgotten by

(Signed) RALPH W. JACKSON,  
EDWARD MELLUS.

## MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH

### RESUME OF COMMUNICABLE DISEASES AUGUST, 1925

#### GENERAL PREVALENCE

There was no increase over the previous month in the number of reported cases of the common communicable diseases.

#### RARE DISEASES

Anterior poliomyelitis was reported from Adams, 1; Boston, 2; Brockton, 1; Brookline, 1; Dalton, 1; Everett, 1; Hudson, 1; Greenfield, 1; Haverhill, 2;

Lawrence, 1; Leominster, 1; New Bedford, 1; Newton, 1; North Adams, 5; Palmer, 1; Pittsfield, 3; Richmond, 1; Seekonk, 1; Springfield, 1; Wellesley, 1; Wrentham, 1; total, 29.

*Dog-bite requiring anti-rabic treatment* was reported from Boston, 7; Clinton, 3; Lowell, 4; Newton, 1; North Attleboro, 1; Revere, 4; total, 20.

*Dysentery* was reported from Boston, 3; Chelsea, 1; total, 4.

*Encephalitis lethargica* was reported from Arlington, 1; Boston, 1; Brockton, 1; Haverhill, 1; Pittsfield, 1; Springfield, 1; Worcester, 4; total, 10.

*Epidemic cerebrospinal meningitis* was reported from Fairhaven, 1; Fitchburg, 1; Leominster, 1; North Adams, 1; Swampscott, 1; total, 5.

*Hookworm* was reported from Boston, 3; Clinton, 1; total, 4.

*Malaria* was reported from Boston, 1; Brookline, 1; total, 2.

*Pellagra* was reported from Boston, 5; Brockton, 1; Danvers, 1; Springfield, 1; total, 8.

*Septic sore throat* was reported from Fitchburg, 2.

*Tetanus* was reported from Beverly, 1; Boston, 2; Chelsea, 1; Lenox, 1; New Bedford, 1; Springfield, 1; total, 7.

*Trachoma* was reported from Boston, 5; Brockton, 1; Medford, 1; Springfield, 1; total, 8.

*Trichinosis* was reported from Boston, 2.

#### DISTRIBUTION

##### All Communicable Diseases

	Aug., 1925	Aug., 1924
Total cases (all causes)	3,031	2,782
Case rate per 100,000 population	75.1	69.5

##### Certain Prevalent Diseases

	Aug., 1925	Aug., 1924
<i>Diphtheria</i>	1925	1924
Total cases	200	380
Case rate per 100,000 population	5.0	9.5
<i>Measles</i>	Aug., 1925	Aug., 1924
Total cases	338	153
Case rate per 100,000 population	8.4	3.8

Cities and towns noticeably exceeding their median endemic indexes\*:

	(2)	23	Lowell	(7)	29
Fall River	(3)	14	Worcester	(4)	54

	Aug., 1925	Aug., 1924
<i>Scarlet Fever</i>	1925	1924
Total cases	179	237
Case rate per 100,000 population	4.4	5.9

	Aug., 1925	Aug., 1924
<i>Tuberculosis, Pulmonary</i>	1925	1924
Total cases	442	405
Case rate per 100,000 population	10.9	10.1

	Aug., 1925	Aug., 1924
<i>Tuberculosis, Other Forms</i>	1925	1924
Total cases	48	65
Case rate per 100,000 population	1.2	1.5

	Aug., 1925	Aug., 1924
<i>Typhoid Fever</i>	1925	1924
Total cases	69	63
Case rate per 100,000 population	1.7	1.5

	Aug., 1925	Aug., 1924
<i>Whooping Cough</i>	1925	1924
Total cases	600	251
Case rate per 100,000 population	14.9	6.3



Cities and towns noticeably exceeding their median endemic indexes\*:

Boston	(53)	209	Andover	(0)	12
Cambridge	(21)	41	Lawrence	(10)	19
Norfolk	(5)	19	Worcester	(15)	56
Quincy	(12)	24	Greenfield	(1)	8

\*The median endemic index is obtained by arranging in arithmetical sequence the monthly totals of reported cases for the past five years and selecting the middle figure. The numbers in parentheses after the name of each city and town indicate the median endemic index for that city or town; the numbers without parentheses indicate the cases reported during the current month.

RHODE ISLAND STATE BOARD OF HEALTH  
CONTAGIOUS DISEASES REPORTED FOR THE WEEK ENDING  
AUGUST 29, 1925

Diphtheria	1	Scarlet fever	5
Whooping cough	3	Pollomyelitis	1
Smallpox	3	Measles	4
Pneumonia	1	Ophthalmia neonato-	
Chickenpox	4	rum	1
Typhoid fever	5	Encephalitis	1

CONNECTICUT DEPARTMENT OF HEALTH

MORBIDITY REPORT FOR THE WEEK ENDING  
SEPTEMBER 5, 1925

Diphtheria	20	Chickenpox	3
Last week	15	Dysentery (bac.)	1
Diphtheria bacilli carriers	2	German measles	1
Scarlet fever	7	Mumps	2
Last week	16	Pneumonia, broncho	9
Typhoid fever	5	Pneumonia, lobar	2
Last week	13	Pollomyelitis	1
Measles	4	Tetanus	1
Last week	2	Tuberculosis, pulmo-	
Whooping cough	43	nary	31
Last week	99	Gonorrhea	19
		Syphilis	16

RECENT DEATHS

SUFFA—DR. GEORGE ALSON SUFFA died at his home in Boston, September 6, 1925, aged 67.

He had been in practice in Boston for 27 years. He was a native of Greenville, R. I., born in 1857, and studied first at the University of Iowa Medical School, then at the Hahnemann Medical School in Philadelphia, where he received his M.D. in 1889. Later he studied at the New York Ophthalmic School, where he received his training as an ophthalmologist. For a time he was on the staff of the Massachusetts Homeopathic Hospital at Westboro. He was a member of the Boston Athletic Association, an active member of the gun club of that body and was keenly interested in hunting. He is survived by his widow, who was Margaret Dixon of New Jersey, and a stepson, A. J. Eveland. Dr. Suffa joined the Massachusetts Medical Society in 1921.

CARTER—DR. HENRY ROSE CARTER, sanitarian, assistant surgeon-general, United States Public Health Service, died at his home in Washington, D. C., after a long illness, September 14, 1925.

The son of Henry Rose and Emma Caroline Coleman Carter, he was born at Clifton Plantation, Caroline County, Virginia, August 25, 1852. He took the degree of C.E. from the University of Virginia in

1873, did post-graduate work in mathematics and applied chemistry at the same university in the two years following, and received the degree of M.D. from the University of Maryland in 1879. He entered the Public Health Service the same year as assistant surgeon and became assistant surgeon-general by special act of Congress in 1915. He developed attention to sanitation, mainly in connection with yellow fever and malaria, and had charge of several yellow fever epidemics in the Southern States, and discovered the extrinsic incubation of that disease in 1900-1901, paving the way to Walter Reed's discovery that the mosquito is the carrier. Many articles from his pen were published in the medical press. Dr. Carter was a member of the Yellow Fever Council, International Health Board, Rockefeller Foundation and sanitary adviser to the Peruvian government, besides holding membership in the American Society of Tropical Medicine and Hygiene and the Royal Society of Tropical Medicine and Hygiene (London).

ELLIOT—DR. JOHN WHELOCK ELLIOT, a former surgeon to the Massachusetts General Hospital, died at his summer home in Needham, September 17, 1925, at the age of 72.

A native of Keene, N. H., he was born October 10, 1852, graduated at Harvard in the class of 1874, and from Harvard Medical School in 1878. After serving as house officer at the Massachusetts General Hospital he went abroad to study, making a specialty of surgery. Soon after settling in Boston he was appointed physician to the Boston Dispensary and assistant surgeon to the Free Hospital for Women (1883-1887). Then he was surgeon to out-patients at that institution, and from 1894 to 1907 he was surgeon to the Massachusetts General Hospital.

Dr. Elliot was clinical instructor in gynecology in Harvard Medical School for two years and lecturer on surgery there from 1900 to 1905. He received an unusually good training in pelvic surgery while at the Free Hospital for Women and did most skillful operating in that department while at the General. He retired from practice in 1913 and gave much time during the World War to Red Cross work, acting as chairman of the New England Surgical Dressings Committee of that organization. Among his memberships were the American Surgical Association, the Massachusetts Medical Society, the Country Club, Tavern Club and the Norfolk Hunt Club. He contributed articles to the Reference Handbook of the Medical Sciences, to the International Textbook of Surgery and to the medical journals.

Dr. Elliot married Miss Mary Lee Morse of Boston town in 1883. She and one son survive him.

REPORTS AND NOTICES OF  
MEETINGS

N. E. SOCIETY OF PSYCHIATRY

THE regular Fall meeting of the New England Society of Psychiatry will be held with Dr. Charles E. Thompson at the Gardner State Colony, East Gardner, Massachusetts, Wednesday, September thirtieth, 1925.

AMERICAN ACADEMY OF  
PHYSIOTHERAPY

THE next annual meeting of this Society will be held October 15th to 17th, 1925, in the Copley Plaza Hotel, Boston.

Clinical demonstrations in physiotherapeutic technique including electrosurgery, will be given in the Boston City Hospital.

All members of the profession are cordially invited to attend this Convention.

Among the subjects to be presented, and those who are expected to participate in the Program are:

Electrophysics, by Prof. Duane of Harvard; Treatment of Sprains, by Dr. Charles P. Hutchins; The Curative Workshop, by Dr. Fred H. Albee; Electrosurgery, by Drs. Wm. D. McFee, Wm. L. Clark and Grant E. Ward; Galvanism in Neurology, by Dr. James MacPhee; The Aftercare of Fractures, by Dr. Harry Eaton Stewart; Hydrotherapy, by Dr. Robert E. Peck; Taking Things for Granted, by Dr. Burton B. Grover; Intestinal Stasis and Toxemia, by Dr. Wm. Seaman Bainbridge and Sir William Arbuthnot Lane, Bart.; Application of Clear Quartz to Physiotherapy, by Dr. Berry; Indications for the Use of X-ray in the Treatment of Breast Tumors, by Dr. Walter C. Barker; Some Reasons for the Delay of the Correlation of Physiotherapy with General Medicine and Surgery and the Specialties, by Dr. Charles F. Stokes; The Rationale of Fraction X-radiation Therapy, by Dr. J. Douglas Morgan, etc.

BYRON SPRAGUE PRICE, *Secretary.*

M. E. G.

#### MEETING OF THE ASSOCIATION OF MILITARY SURGEONS

THE Association of Military Surgeons of the United States will hold its annual meeting at the Hotel Waldorf-Astoria, New York, October 8th to 10th. Official delegates from eighteen foreign countries will participate. The programme will include visits to West Point, Ellis Island, the Army Medical Supply Depot, the Naval Hospital and Medical Supply Depot in Brooklyn, the airdrome at Mitchel Field on the day of the Pulitzer race, the Rockefeller Institute and various hospitals, and a review of and demonstration by the 102nd Medical Regiment of the 27th Division.

Physicians who are serving or have served in the Army, Navy, Marine Corps, the Reserve, the National Guard or the Public Health Service are eligible for membership. The dues, \$5 per year, include subscription to an excellent monthly journal, *The Military Surgeon*.

#### WORCESTER DISTRICT MEDICAL SOCIETY

THE Worcester District Society held a joint meeting with the Worcester Ninth District at the Worcester Country Club September 9, 1925.

In the afternoon several of the members enjoyed some golf in the championship course of the club.

At five thirty, Pres. Royal P. Watkins presided

at a short business meeting which was immediately followed by dinner.

After dinner Dr. A. W. Murek reported the results from the use of the Physicians & Surgeons Telephone Bureau, conducted by the local Chamber of Commerce during the past year.

Dr. J. A. Barton of Fitchburg, President of Worcester North made a short address.

Dr. Harold M. Frost of Boston then gave a very interesting talk on "Periodic Health Examinations: Their Scope and Function." Dr. Frost explained the purpose and aim of the Massachusetts Public Health Service in advocating these examinations. Dr. Ernest L. Hunt of Worcester led the discussion which followed Dr. Frost's talk.

The meeting was adjourned by Pres. Watkins at nine p. m.

E. E. FIPPEN

#### MEETING OF NEW ENGLAND SURGICAL SOCIETY, OCTOBER 2d AND 3d, 1925, AT SPRINGFIELD, MASS.

##### TENTATIVE SCIENTIFIC PROGRAM

1. "Lessons from Two Operative Fatalities," Farrar Cobb
2. "The Problem of Operative Deaths," E. L. Hunt
3. "A Case of Retroperitoneal Cyst," J. D. Barney
4. "Report of a Case of Volkmann's Contracture, Involving the Pronator Quadratus Muscle," J. S. Stone
5. "The Study of Some Tumors of the Kidney," A. L. Chute
6. "Intercostal Drainage in the Treatment of Empyema," D. C. Patterson
7. "Preparation of Patient for Anesthesia," H. P. Stevens
8. "Notes on Treatment of Surgical Diabetics," R. C. Cochrane
9. "Torsion of Duodenum from Post-Operative and Inflammatory Adhesions—with the Report of Four Cases," D. Carleton
10. "The Fracture Committee of the American College of Surgeons," C. L. Scudder
11. "Gall Bladder Surgery," W. C. Seelye
12. "Iodine in the Treatment of Exophthalmic Goitre," E. P. Richardson
13. "Obstruction of the Common Bile Duct," P. E. Truesdale
14. "Intestinal Obstruction," G. A. Moore

##### SOCIETY MEETINGS

###### DISTRICT MEDICAL SOCIETIES

###### Essex North District Medical Society

Wednesday, January 6, 1926—The semi-annual meeting at Haverhill.

Wednesday, May 5, 1926—The annual meeting at Lawrence.

###### NEW ENGLAND STATE MEDICAL SOCIETIES

The annual meetings of the New England State Medical Societies are scheduled as follows:

Vermont State Medical Society—St. Johnsbury, Oct. 15-16, 1925.  
Notices of meetings must reach the JOURNAL office on the Friday preceding the date of issue in which they are to appear.